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Concrete Mixing Machinery

Civil Engineering

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CONCRETE MIXING MACHINERY

BY

JOHN ANDREW DAILEY

THESIS

FOR

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C O L L E G E O F E N G I N E E R I N G

May 24, 1907.

This is to certify that the following thesis prepared under the immediate direction of Mr. C. C. Wiley, Instructor in Civil Engineering, by

JOHN ANDREW DAILEY

entitled CONCRETE MIXING MACHINERY

is accepted by me as fulfilling this part of the requirements for the Degree of Bachelor of Science in Civil Engineering.

Ira O. Baker

Head of Department of Civil Engineering

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Introduction.

An examination of engineering construction of recent years will show, even the most unobserving, that concrete holds one of the most important positions as an engineering material; and also that its rise to this position has been extremely rapid and universal. It is still growing in importance, and the result is a demand for some method of thoroughly mixing large quantities rapidly and economically.

The earlier method of mixing concrete by hand, though suitable for small quantities, is obviously unsuitable when masses of from 20 to 100 tons a day are in question. It has been claimed for hand work that the intermixing of the ingredients is more thorough than that effected by machines. But even if this claim could be sustained in the present day, which is not

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the case, it would not alter the fact of the impossibility of mixing large quantities by hand, except at the ruinous expense of a large body of men. Hence the advent of the concrete mixing machine, which owing to the increased demands made upon it, is continually growing in importance.

In any successful mixer certain conditions must be fulfilled. The ingredients must be amalgamated thoroughly to insure uniformity of product; the charging side must be as near as possible to the ground to avoid cost of raising the materials; the discharge side must be elevated enough to empty into a barrow or car to save shovelling; the machine must be rapid in action, and the less attendance required the better.

Concrete mixers are of two general classes. They are either intermittent or continuous in action. In the first class a separate charge has to be inserted for each mixing; in the second, the

materials enter and are discharged in a continuous stream. But within this very broad classification several types are included. The machines may consist of hollow boxes, cubical, cylindrical, or oblong in shape. They may contain internal blades for churning and mixing the materials, which blades may revolve along with the machine, or they may rotate, the machine body being fixed. Again the blades may be arranged longitudinally, transversely, or spirally. On the other hand, the mixing chamber may be without internal blades, the materials being carried up and thrown down by the act of revolution. Furthermore, while in some mixers the water is added with the charge, in others it is not admitted until the dose dry materials are at least partially intermixed. With regard to each of these devices there is room for the expression of differences of opinion, but theoretical considerations will not be discussed, and all the mixers to be mentioned in this work are practically working machines now on the market.

- Concrete Mixing Machines
  - Batch
    - Drum
      - Ransome - non-tilting p. 5
      - Gotham - " " p. 8
      - Chicago - " " p. 11
      - Colorado - " " p. 13
      - McKelvey - " " p. 15
      - Smith - tilting p. 17
      - United - " p. 20
      - American - non-tilting p. 22
      - Broughton " " p. 25
      - Clyde Iron Works " " p. 27
    - Cube
      - Chicago Improved - tilting p. 29
      - Judd - non-tilting p. 32
    - Gravity - Hains p. 34
  - Continuous
    - Trough
      - Drake p. 37
      - Trump p. 42
      - Foote p. 46
      - Eureka p. 49
      - Scheiffler p. 51
      - Jeffrey p. 53
      - Indiana Scholl p. 55
    - Drum
      - McKelvey p. 57
      - Tenorest p. 58
      - Cook p. 61

Ransome Mixer

The Ransome machine manufactured by the Ransome Concrete Machinery Company is a horizontal trough mixer of the batch type. The mixing chamber consists of a cylindrical steel drum (Plate I) the wall of which is ribbed with a series of narrow steel blades, or scoops, which extend diagonally from end to end of the drum and terminate in a bend. Riveted to each of these ribs near the bend, is a deflector which extends at a tangent thereto with its outer end resting on the edge of the next adjacent scoop. These scoops pick up the material in the bottom of the mixer, and as the drum revolves, carry it upward until it slides out of the scoops, striking the deflector which in turn throws back across the machine. Each scoop serves as a shovel, lifting up a portion of the batch and owing to the diagonal set of the ribs,

causes the material to slide toward the discharge end. The scoops are shaped and staggered in such a way that the materials are forced to travel from the rear of the mixing drum to the front and then travel back again, no matter how the materials enter the mixer. In addition, part of the concrete is carried up by the scoops in the blades to the highest point of the mixer, and dropped into the mass below.

To discharge the concrete no tilting of the machine is required. A steel discharge chute (Plate I. Fig. 2) is lowered in place by the operator as shown. The inner end of this chute catches the material forced out of the drum, and conveys it out of the mixer at a height sufficient to allow it to pass into a wheelbarrow, car, or bucket. Because the machine does not tilt to discharge, it can be set down in the ground, thus lowering it and reducing the overall height. No auto-matic device is used to measure

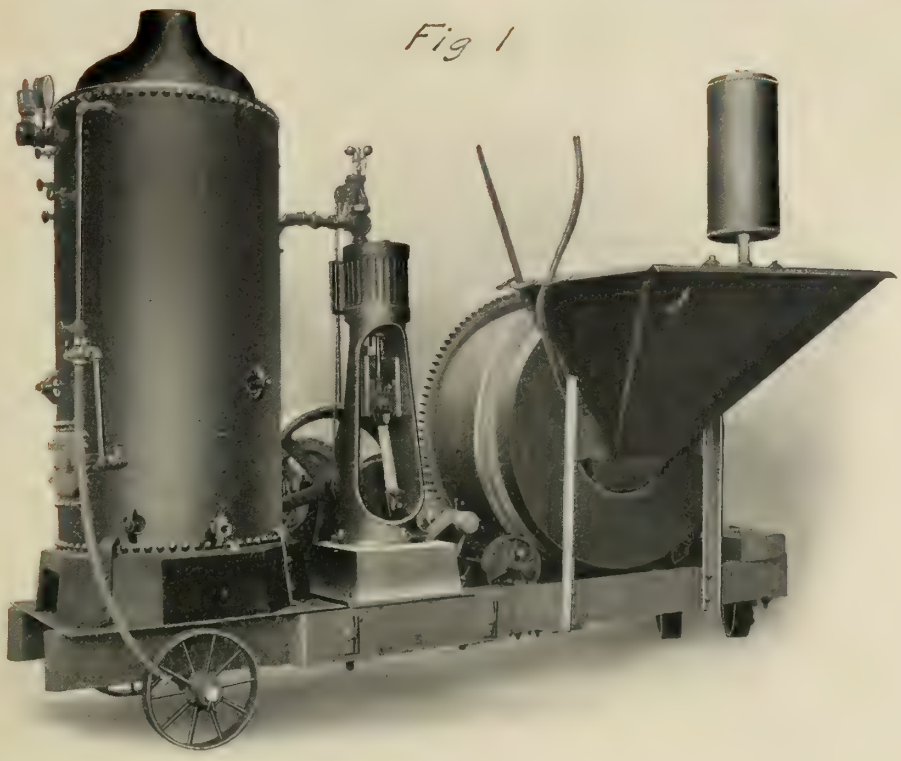
the materials before charging. They are shovelled into a hopper from which they pass directly into the drum. (Plate I. Fig. 1) A water measuring tank is sometimes set over this hopper by which the water feed is controlled (Plate I. Fig. 1) The drum rotates continuously, both when discharging and when being charged at the rate of about 15 revolutions per minute.

The drum is supported at each end on two rollers which form bearings for its motion. (Plate I. Fig. 2) One of the roller shafts is fitted with a driving pulley, and also with a pinion which meshes with a gear ring on the drum and causes the latter to rotate. The power required is comparatively small because the friction is decreased by means of the roller bearings.

The Ransome machine is made in four sizes ranging in capacity from 10 to 40 cubic yards per hour. List price of mixer only $425.00 to $630.00

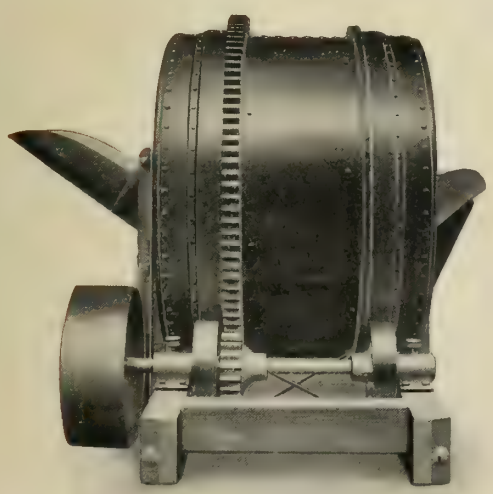
Plate I

Fig 1



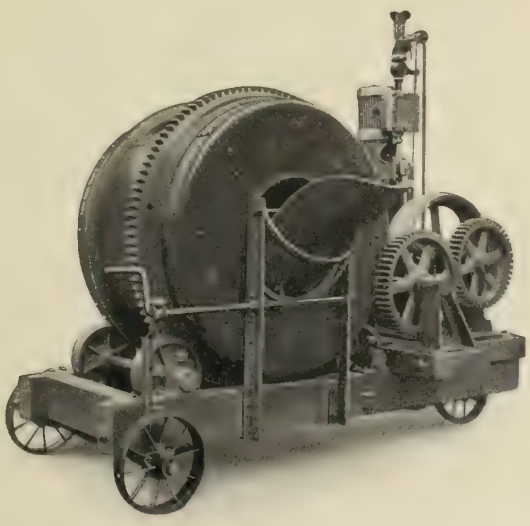
RANSOME CONCRETE MIXER WITH FEED HOPPER AND WATER MEASURING TANK.

Fig 2



RANSOME MIXER ON SKIDS, WITHOUT POWER

Fig 3



RANSOME MIXER ON TRUCKS, WITH ENGINE.

Gotham Mixer

The Gotham is another type of batch mixer manufactured by the United Concrete Machinery Company. (Plate I) The mixing chamber consists of a cylindrical steel drum mounted on four rollers. (Plate II. Fig. 1) It contains no movable parts but is provided with deflector blades fixed to the wall of the drum. These blades extend diagonally from end to end of the drum and pick up the material in the bottom of the mixer. As the drum revolves part of the aggregate is thrown from side to side and the remainder is carried up until overcome by the action of gravity, when it is drooled down into the mass below.

To discharge the machine a steel discharge chute is lowered in place by means of a lever. (Plate II. Fig. 1) The inner end of this chute catches the material from the deflector blades and conveys

it out of the drum. The delivery of concrete from the mixer can be regulated at will or stopped entirely at any time by inclining the discharge chute at the proper angle to give the desired result. This permits the discharge of either the whole, or a portion of the batch at any time.

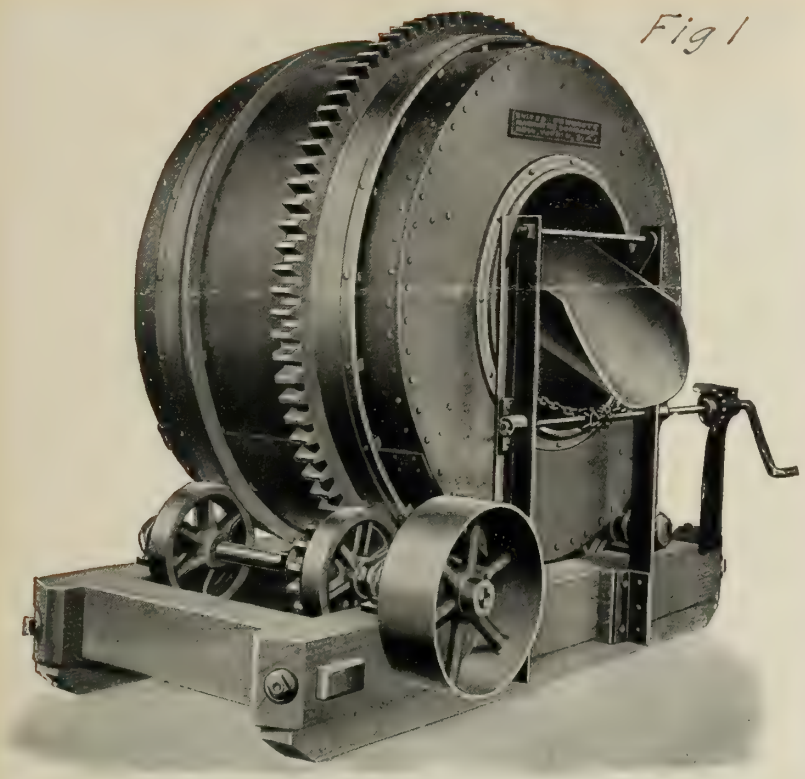
The machine can be charged direct from wheelbarrows, or may be equipped with a charging hopper. (Plate II. Fig. 2) This hopper is large enough to hold a full batch, so that one batch can be placed in the hopper while the preceding batch is being mixed in the drum. After the first batch is discharged, the gate of the hopper is closed and the second batch dumped into the drum. The hopper does not measure the materials. Water is admitted to the drum through the same opening as the materials.

The drum rotates continuously both when discharging and when being charged. One of the rollers shafts

is fitted with a driving pulley and also with a pinion which meshes with a gear surrounding the drum and causes the latter to rotate. (Plate II. Fig 1)

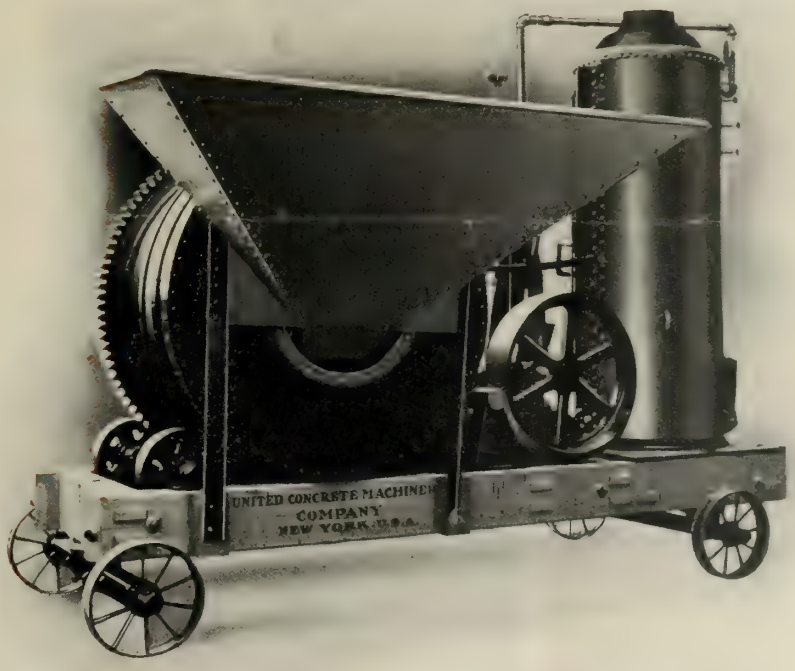
The Botham is made in four sizes ranging in capacity from 10 to 40 cubic yards. Can be moved when fed from wheelbarrows. If charging hopper is used the capacity is about doubled. The horse power required varies from about 5 for the smallest size up to about 20 for the largest size.

Fig 1



GOTHAM MIXER, PULLEY STYLE

Fig 2



GOTHAM MIXER, SHOWING CHARGING HOPPER

Chicago Mixer

A drum mixer of the batch type is manufactured by the Chicago Concrete Machinery Company. (Plate III) The outer form of the drum is cylindrical, as shown in the illustration, but deflector blades are riveted across the corners of the drum which give the inner surface a cubical formation. Inside of these, and riveted to the wall of the drum, are four more blades arranged in the form of a spiral, which carry the material up the sides of the drum and cast it down again as the drum revolves. The mixing is really a combination of the cube movement and the rotating drum with blades.

When the batch is mixed, a light steel chute is inserted into the drum by means of which the material is removed into wheelbarrows, or other convenient receptacle. (Plate III (Fig. 1)) To charge the machine the materials are shovelled into a hopper from

which they pass through an opening directly into the mixing chamber. (Plate III. Fig 2) Water is admitted in the same manner at the same time, or at a later period as the operator may choose. The drum rotates at the rate of about 15 revolutions per minute.

The drum is mounted on four rollers which in turn are mounted on a frame. (Plate III. Fig. 3) On the frame is also mounted a shaft provided with two pinions, which mesh with two large gear rings encircling the drum, thus causing the latter to rotate. (Plate II. Fig 2)

These machines range in capacity from 3 to 15 cubic yards per hour, depending upon the size. Four sizes are made, requiring from 2 to 8 H.P. for operation. List price without power $190.00 to $450.00

Plate III

Fig 1

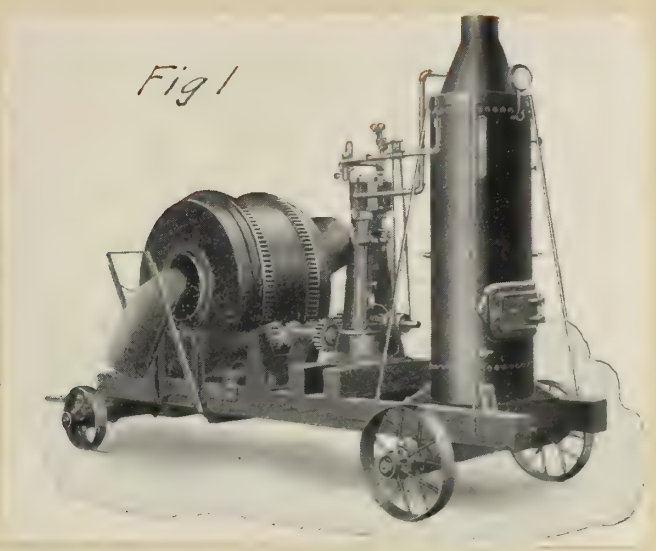


Fig 2

Chicago Concrete Mixer on skids with pulley, ready for power-charging side.

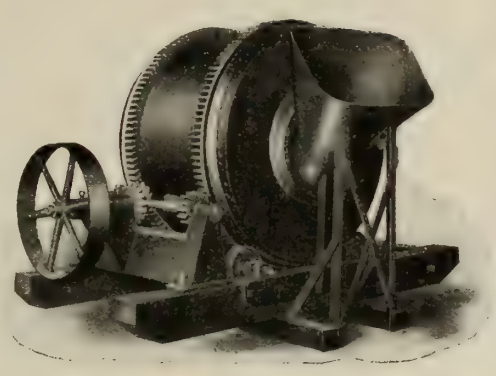
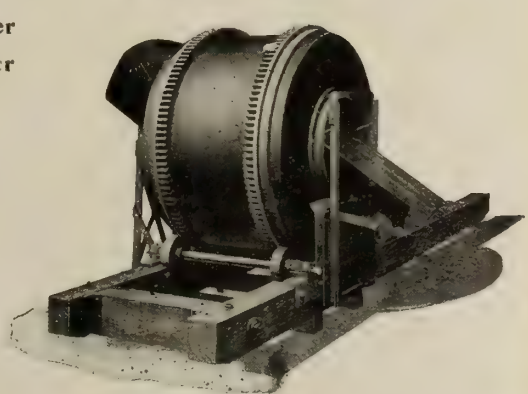


Fig 3

Chicago Concrete Mixer on skids without power discharge side



Colorado Mixer

The Colorado Concrete Machinery Company manufacture a machine of the drum batch type. (Plate II) Within and fastened to the shell of the mixing chamber, which is a large cylindrical drum mounted to rotate on rollers, are a number of buckets and wedge-shaped blows. As the drum rotates, the buckets carry up a great portion of the material a short distance, the portion which falls back being shut in two by the wedge shaped blows which alternate in the drum with the buckets. The blows which the buckets retain is thrown down to the bottom by the centrifugal force of the revolving drum. As the machine continues in action, this movement is kept up until the desired effect is secured. The shape of the buckets and the wedges or blows set up an action which alternately draws the material toward the center of the drum

and pushes it out toward the ends. The drum makes about 15 revolutions per minute.

The machine is discharged by means of an inclined chute (Plate IV. Fig. 2) which passes through the drum, and by means of sliding the upper part of this chute, by the operation of a lever, the whole batch or any part of it can be discharged. During the mining period this chute is not continuous, and the material instead of passing into it from the buckets falls to the bottom of the drum. The charging chute is low to the ground, so that the materials have to be raised only about two feet (Plate IV. Fig. 1), to place them in the drum. Water is introduced through a hose.

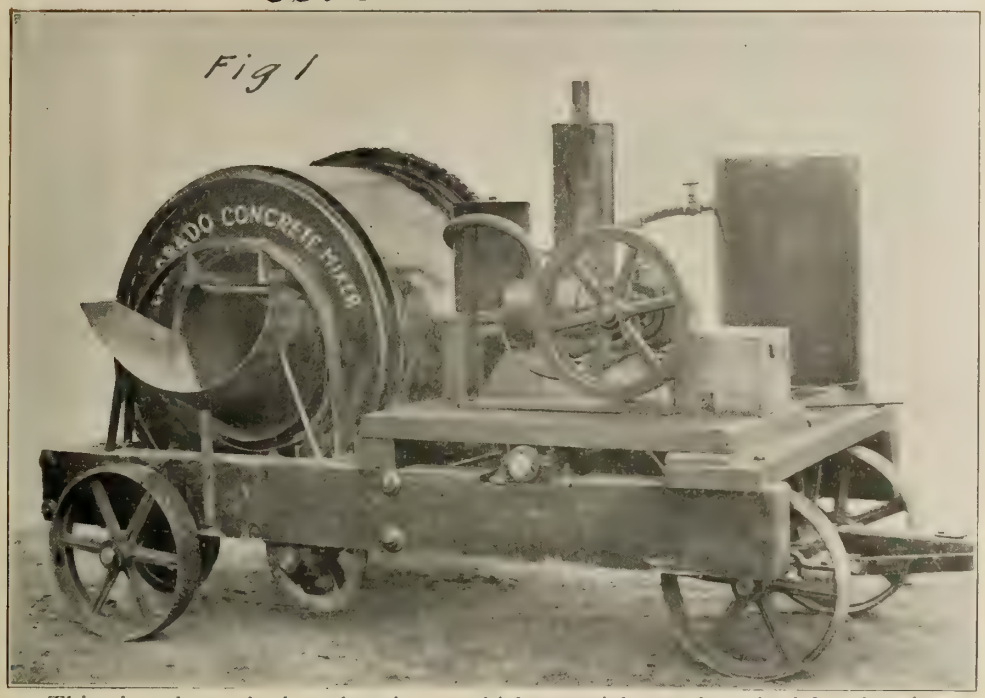
The whole machine is mounted on trucks, and the mining chamber is rotated by means of a chain and sprocket. (Plate IV. Fig. 2) The chain passes completely around the drum and engages with a small cog sprocket mounted on the main shaft.

Four sizes of the machine are made with capacities from 8 to 45 cubic yards per hr.

Plate IV

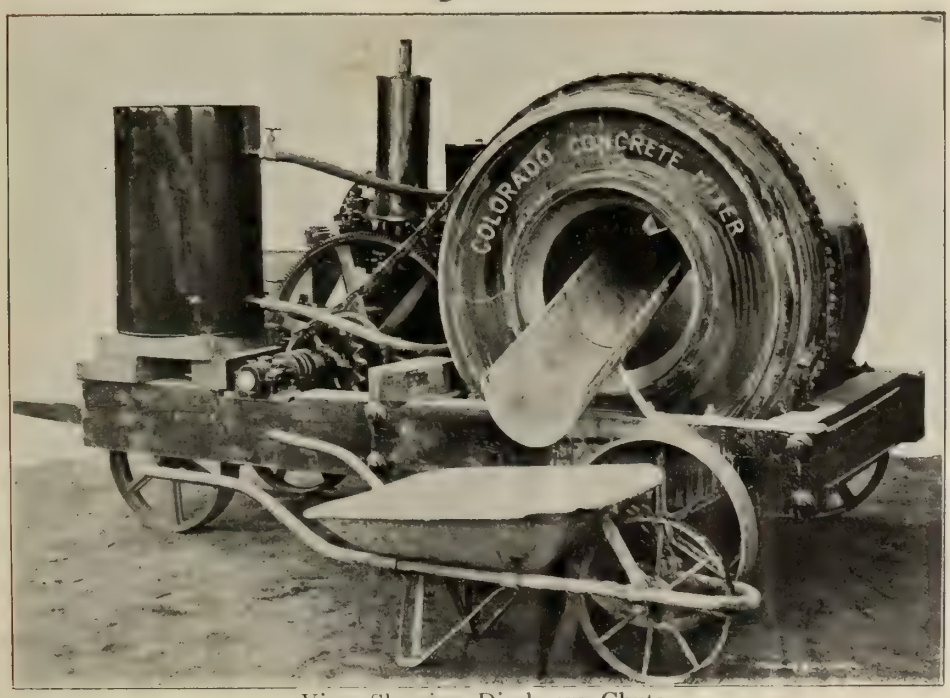
COLORADO MIXER

Fig 1



This view shows the low elevation to which material must be raised for charging

Fig 2



View Showing Discharge Chute

McKelvey Mixer

The McKelvey Concrete Machinery Co. manufacture two machines, a batch mixer and a continuous mixer, both of the drum type.

The batch mixer consists of a cylindrical steel drum, mounted on four rollers. (Plate V) Pivoted to the inner shell of the rotating drum are a series of shovels shown in Fig. 2, Plate V. The top edge of the shovel lies against the rising side of the drum and collects the material in that portion of the drum. When the shovel is filled the overflow slides rapidly off the lower edge, and the balance is carried upward to a point where gravity causes the shovel to cast it outward and downward, turning it over in the fall.

The machine has a low feed level, and a discharge at a height sufficient for conveniently removing the concrete. (Plate V. Fig. 1). The materials, together with the water, are

fed into the drum through an opening in one side. On the other side is a long discharge chute. (Plate V. Fig. 1) which projects out far enough to deposit the concrete into a wheelbarrow, or similar receptacle. The lever on the drum operates the discharge. The drum is fed and discharged while in motion, and does not change its position either in feeding or discharging.

The mixing drum is revolved by means of a chain, which runs on a large sprocket wheel encircling the drum. (Plate V. Fig. 1) This chain is run by a smaller sprocket mounted on a shaft propelled by a set of gears operated from the engine or other motive power.

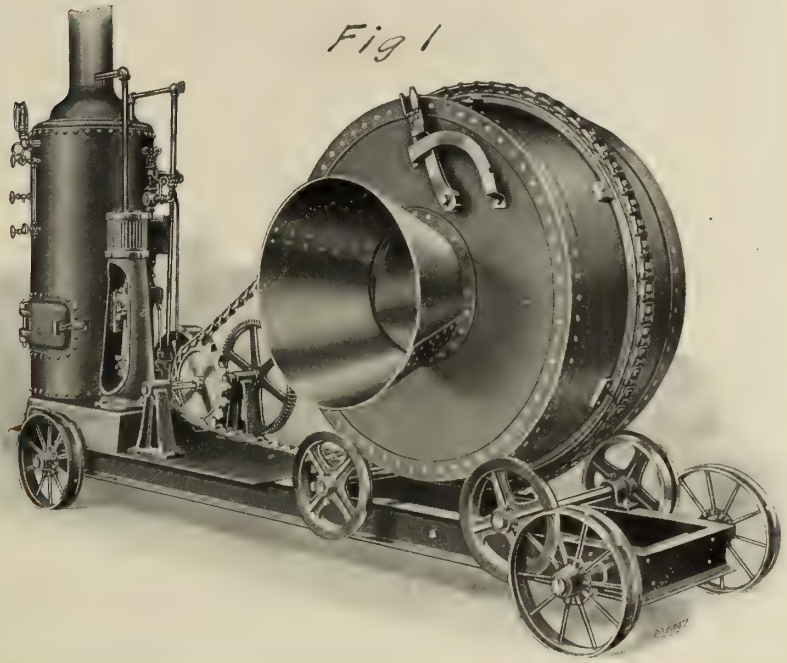
The capacity of the machine varies with the size from 3 to 25 cubic yards per hour. The machine is made in six sizes.

The other machine will be described under continuous mixers.

Plate V

McKELVEY BATCH MIXER

Fig 1



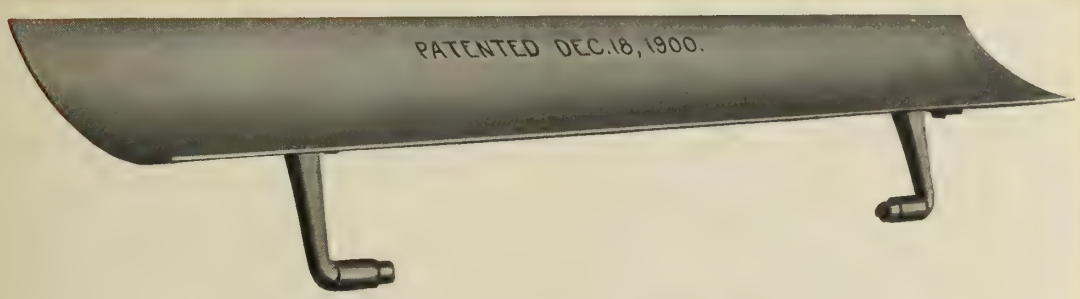


Fig 2

OPERATION OF THE GRAVITY SHOVEL.

Smith Mixer

One of the simplest machines of the batch type is the Smith mixer manufactured by the Contractors Supply & Equipment Company of Chicago. (Plate VII.) The mixing chamber consists of two truncated cones with their larger ends joined together and their smaller ends open, and rotating on the axis of the cones. This chamber is supported and guided by a frame, which can be tilted at will while the drum is revolving (Plate VII. Fig 1) In one end a chute is fitted by means of which material is fed into the machine. Water is added through the same opening. An automatic measuring tank can be furnished upon application, which will measure any desired quantity of water up to the largest quantity required for a batch. Within the mixing chamber are a series of blades riveted to the wall of the drum, which project radially inward. (Plate VII Fig 2)

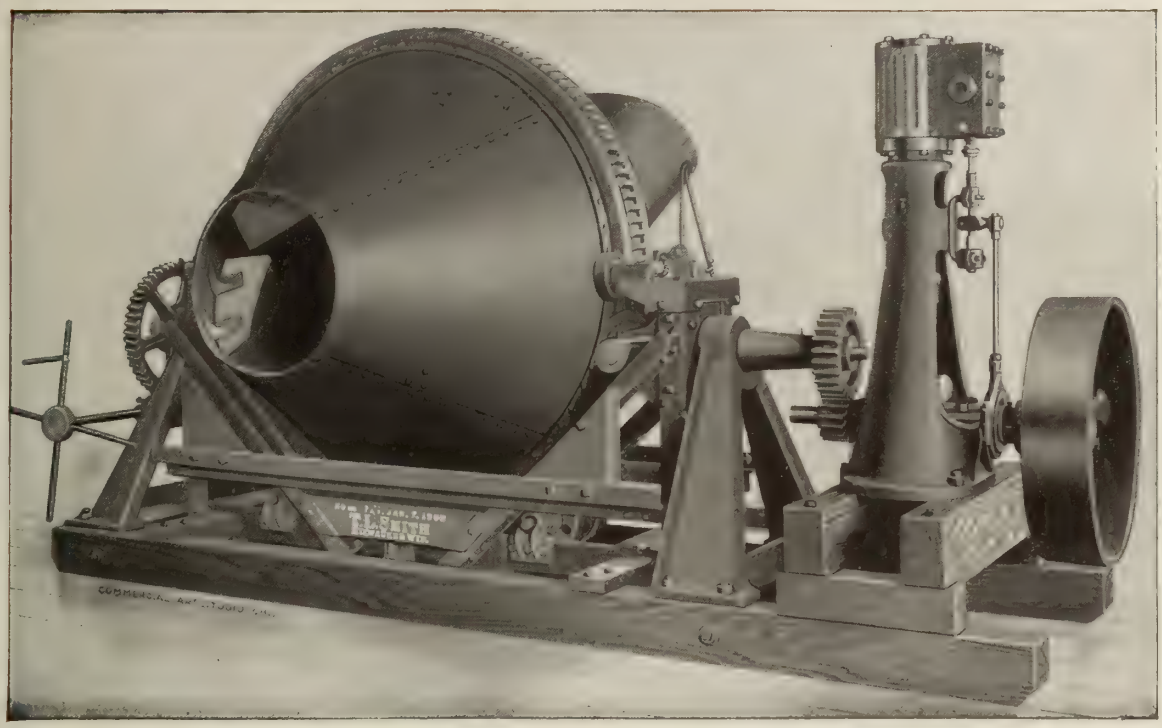
It will be observed that they follow the general outline of a spiral screw-thread, and are adapted to carry the material from the center of the chamber toward the ends. The thread, however, is not continuous, and as the revolves the materials droh through the gaps between the blades and slide down the inclined conical walls to the center of the chamber. The arrangement of the blades and the conical form of the drum cause a thorough mixing of the batch and since there are no pockets or corners within the chamber the possibility of clogging is entirely done away with.

When the batch is mixed, the drum is tilted down by turning a lever at the side of the machine, (Plate II. Fig 1) and the materials are plowed out. The drum is mounted to turn on rollers in a swinging frame, the latter being journaled to a fixed frame. (Plate II. Fig. 1) The driving mechanism comprise a pair of miter gears, one keyed to one

of the idler of the swinging frame, and the other carried by the swinging frame. Secured to the shaft, on which the latter gear is mounted, is a small spur pinion that meshes with the gear ring on the mixing drum. Power is transmitted to the mechanism by a driving pulley or by gears.

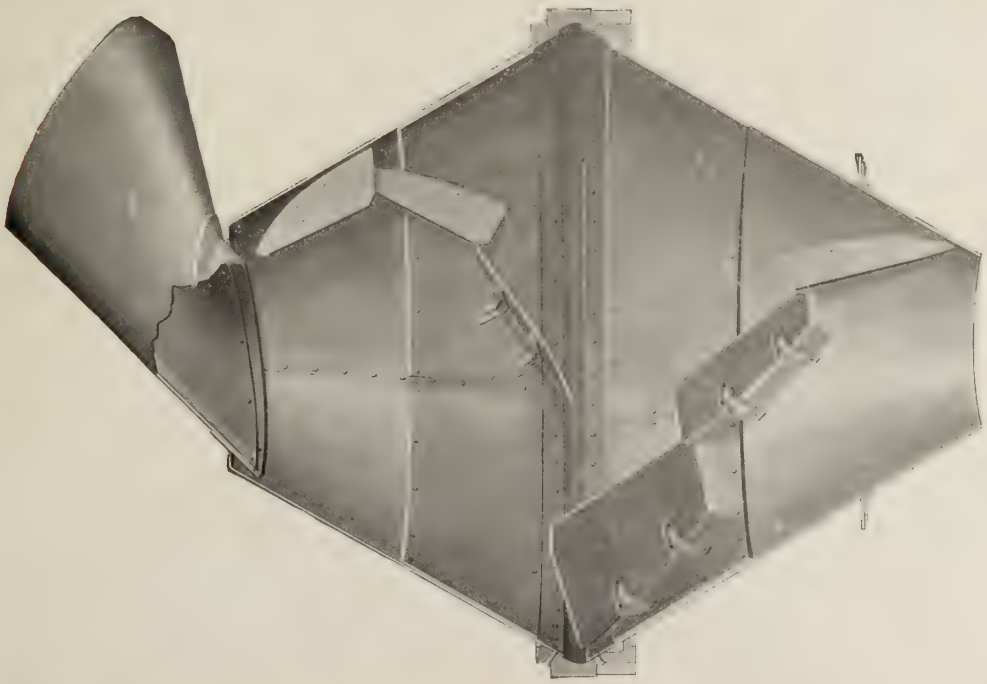
The Smith machine is made in five sizes, ranging in capacity from 4 to 62 cubic yards, per hour. The H. P. required ranges from 4 H.P. for the smallest size to 19 H.P. for the largest machine.

Fig 1



Smith Mixer on Frame, with Engine Only

Fig 2



Cross Section of Drum (front half cut away), showing blades and lining.

United Mixer

Another tilting mixer of the batch type is manufactured by the United Concrete Machinery Company. (Plate VII). The mixing chamber is in the shape of a drum formed with a large pyramidal chute at its discharge end. Inside the drum are placed radial blades which lift the material high in the interior of the drum and cast it down again upon a stationary coating table, which tends to grind the materials together. The back and forth motion is obtained by means of the inclined faces of the pyramidal shaped end.

The drum is mounted to revolve in a ring, which in turn is designed to rotate on an axis in the same plane as, but at right angles to, that of the drum. (Plate VII. Fig. 1) Mounted on this ring is an engine of the square piston type, which drives the drum directly by means of spur gearing. Steam is fed to this engine through a flexible tube. (Plate VII. Fig 1)

The tipping of the drum is also accomplished by steam power. Connected by a pitman with the axis of the spur gear is a piston which works in a steam cylinder on the main frame. (Plate VII. Fig. 1) When the piston is moved to its extreme rearward position it draws the entire ring frame and mixing drum back, causing them to tip down slightly. This lowers the charging chute so that the materials can be more easily fed into the drum. No automatic charging device is used, the materials being shovelled into the receiving hopper at one side of the drum. Water is also admitted through the same opening. When the piston is driven to the extreme forward end of its stroke, the drum is tipped down and the contents pour out. (Plate VII. Fig. 2).

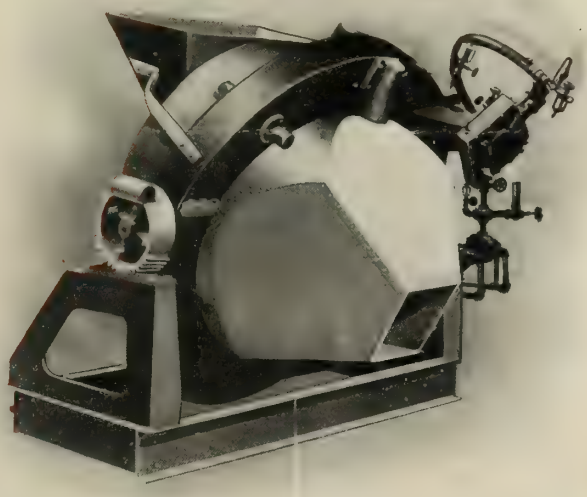
The United Mixer is made in three sizes. The smallest averages about 10 cubic yards per hour, while the largest has a capacity of 30 cubic yards per hour.

Plate VII

Fig 1

UNITED MIXER

Fig 2



American Mixer

The American mixer is made by the International Fence & Fireproof Company of Columbus, Ohio. (Plate VIII).
It is a batch mixer, provided with a heavy mixing drum having but one opening. Through the center of the drum extends a steel shaft to which plow arms are keyed. (Plate VIII. Fig. 2) They in turn carry steel blades which are riveted to the ends of the arms. The two center arms converge so as to form a V shape. The outside shovels are set in advance of the center shovels, and at sufficient angle to cause the materials to be moved toward the center of the drum. Here they are met by the center shovels, which in turn throws the batch toward the ends. They mix by turning the materials over many times, bringing the bottom to the surface, doubling it back and grinding the entire batch together. During the mixing process the drum remains stationary

in an upright position. (Plate VIII. Fig. 1)

To discharge the machine, a friction clutch on the main gear shaft is brought into play, by means of a lever, and the drum is turned about one-quarter round into the discharging position. (Plate VIII. Fig 2). Upon releasing the lever the drum automatically returns to its upright position.

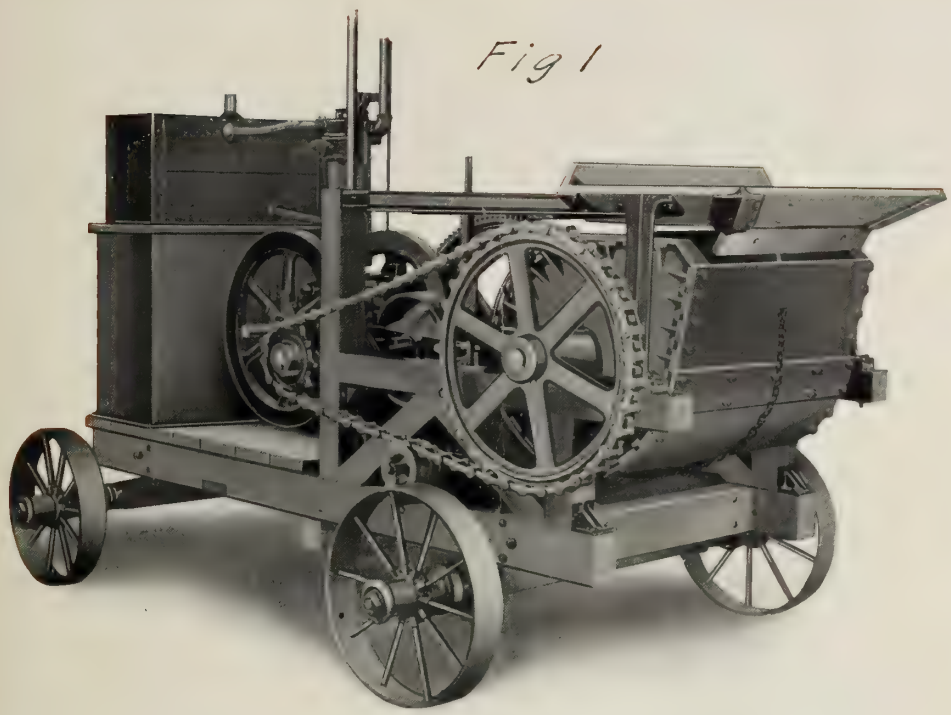
The driving mechanism consists of a large sprocket wheel on the side of the drum, mounted on the same shaft as the revolving shovels. (Plate VIII. Fig 1) This wheel is rotated by means of a chain, which engages a smaller sprocket wheel on the engine shaft. This latter shaft is propelled by means of gears connected directly with the engine. The machine is charged and discharged while running at full speed. No automatic measuring device is used to charge the machine, and all the materials must be raised to a platform above the mixer before being placed in the drum. The machine will not

discharge into barrows conveniently, because the opening in the drum is too large. It can better be discharged into a car, or onto a platform. The machine can be mounted for side or end discharge as desired.

Four sizes of the American are made, ranging in capacity from 6 to 20 cubic yards per hour. The horse power required varies from 3 H.P. to 8 H.P., depending upon the size. List price of mixers, on skids without power. $350.00 to $600.00

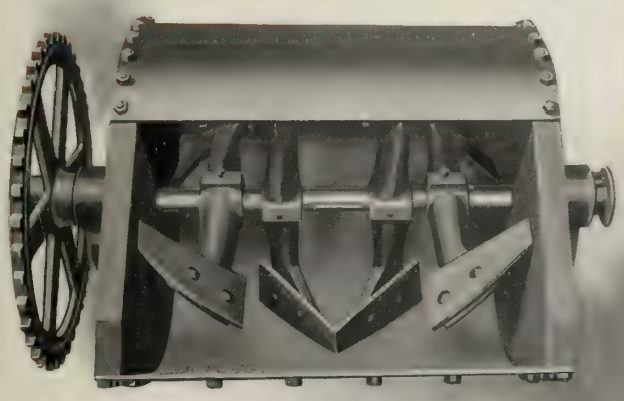
Plate VIII

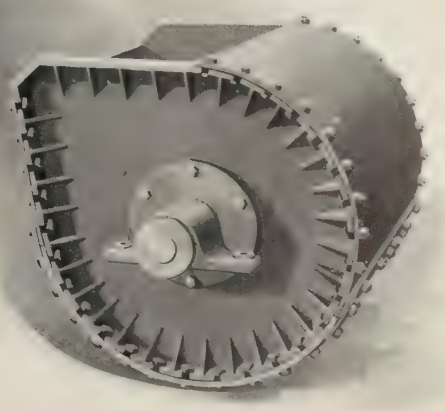
Fig 1



AMERICAN MIXER ON TRUCKS (END DISCHARGE) WITH FAIRBANKS-MORSE GASOLINE ENGINE

Fig 2





Broughton Mixer

The Broughton batch mixer, manufactured by W. D. Dunning, is adapted for mixing materials for all kinds of light concrete, especially where the concrete is required to be put in sacks. (Plate IX.) It has two shafts running horizontally, side by side, through the mixing chamber. (Plate IX. Fig 2) This chamber is a cast iron case with a semi-circular bottom and vertical sides. Paddles are placed on the shafts at at an angle, and the shafts being geared to rotate in opposite directions, the paddles on their outer movement toward the center lift the materials from the bottom of the case, and in so doing one set of paddles cast the mixture toward one end of the case, while the other set cast it to the opposite end. Where the shafts pass through the case, stuffing boxes are provided to prevent any leakage.

The discharge is effected through

two openings in the bottom of the mixing chamber directly beneath the shafts. To each of these openings is attached an automatic bag holder, so that the materials are discharged directly from the mixing chamber into the bags. (Plate IX. Fig. 1) The receiving chamber passes through the floor above, the upper end forming a hopper to receive the material, the lower end being fitted with a cast iron slide arrangement which is operated by means of a lever. (Plate IX. Fig. 1) This opening, being 10 inches square, affords ample room for the materials to pass freely to the mixing chamber below. Water is admitted by opening a valve in a perforated pipe which is attached to a water tank at the end of the mixer. The water is added in the form of a shower and is taken up and absorbed by the materials as they enter the mixing chamber.

The machine is driven by a belt and pulley (Plate IX. Fig. 1) Three sizes of the machine are made, ranging in capacity from 3½ to 11 cubic yards per hour. List price $200.00 to $350.00.

Plate IX

Broughton Mixer.

[PATENTED.]

STYLE B—No. 1.

Fig 1

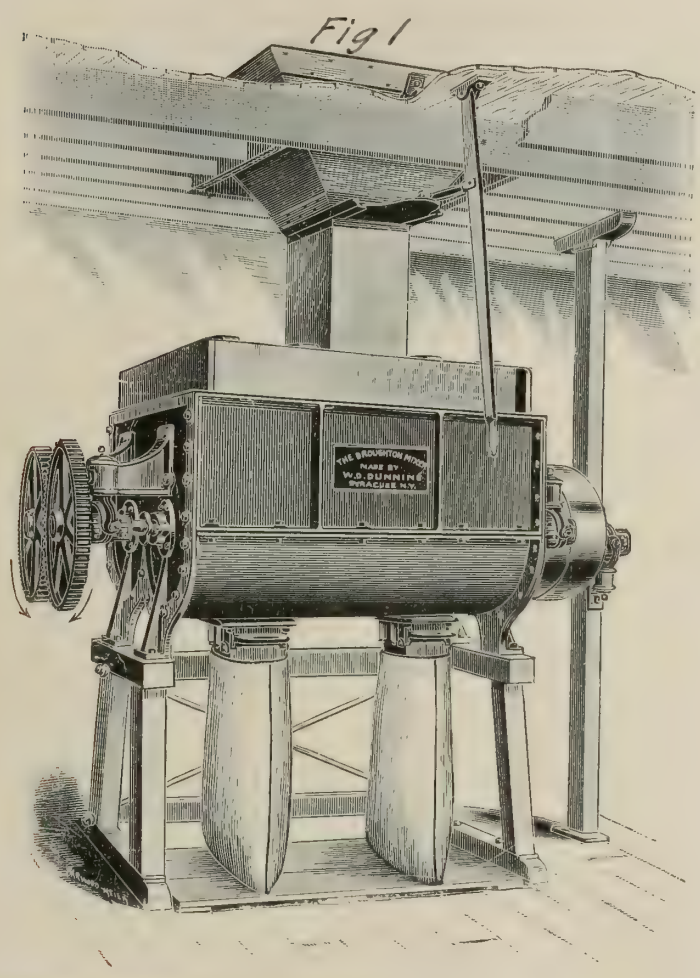
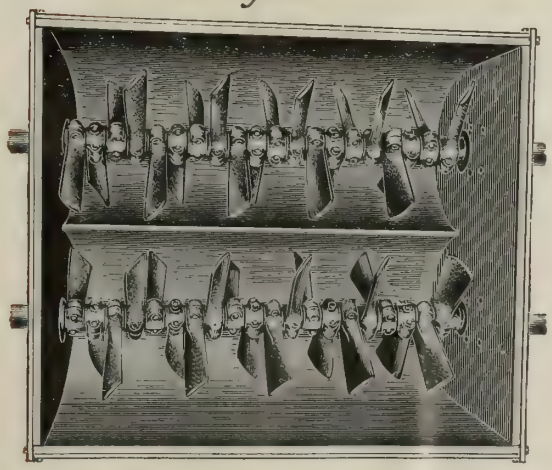


Fig 2



[INTERIOR OF CYLINDER—PATENTED.]

Clyde Iron Works Mixer

This mixer is a batch mixer, and consists of a large revolving pan within which are plows supported by an iron frame and held in position by a heavy vertical shaft passing through the center. (Plate X) The revolving pan runs on a ball bearing cast steel base, and is driven by a pinion which engages a gear rim on the outer edge. (Plate X) The plows remain stationary, the material to be mixed being carried around by the revolving pan. One set of plows are right hand, extending from the inner to the outer circle, taking in all the material and turning it over. The plows following are left hand and turn the entire mass back again. (Plate X. Fig. 2) This operation is kept up until a satisfactory mixture is obtained. At all times, the material is in plain sight, and the water is added by simply pouring it into the top of the revolving pan.

When charging or discharging the

machine, the plows are raised. The discharging is done automatically through three trap doors, arranged in the bottom of the mixing chamber. When the mixing is completed, the plows are raised, a scraper is dropped down, and at the same time a dog is thrown into the gear which opens and closes the trap doors when they reach a certain point; thus dumping the batch in one place. Materials to be mixed can be stored in bins above the machine and shoveled into it, or they can be dumped into it from wheelbarrows.

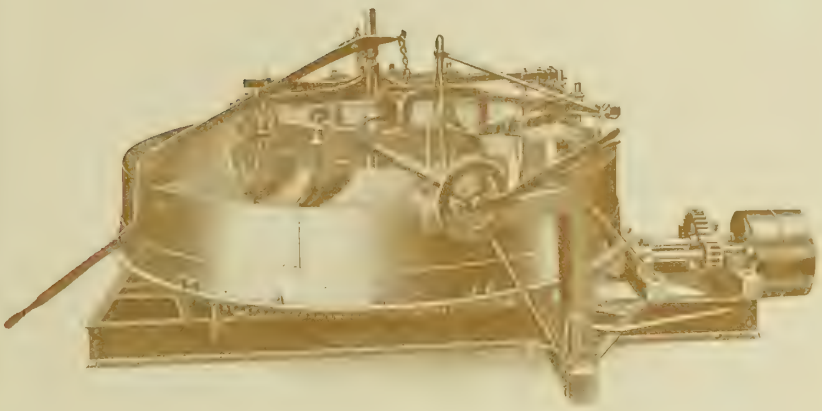
The machine is mounted on skids, and run by a belt from the engine, or other driving power. (Plate X figs. 1 & 2) About 4 H.P. to 7 H.P. are required for successful operation, depending on the size of machine. Three different sizes are manufactured, ranging in capacities of $\frac{1}{3}$, $\frac{1}{2}$, and 1 cubic yard per batch. The smallest size has a revolving pan 6 feet 6 inches in diameter, and the largest 10 feet 6 inches.

Plate X

CLYDE IRON WORKS

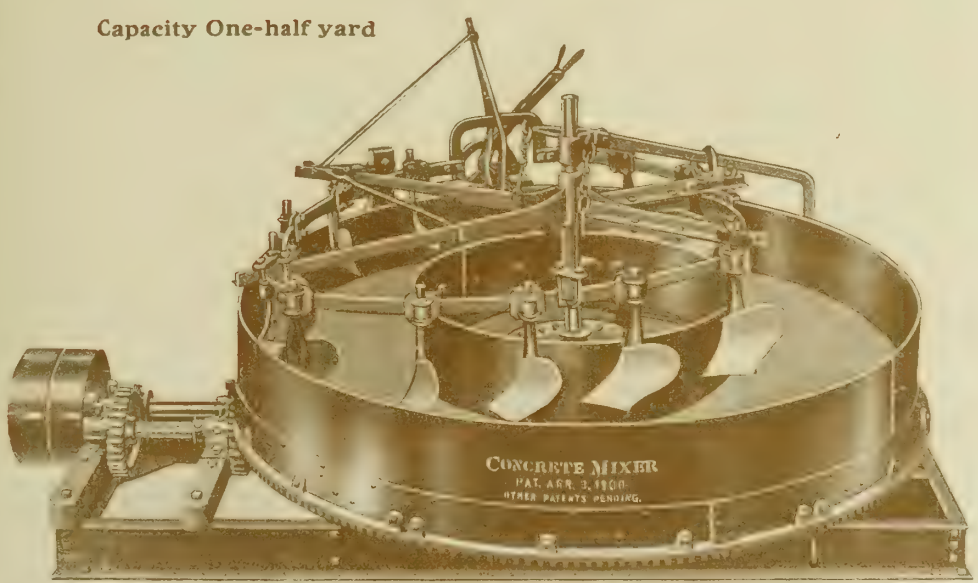
No. 1 Mixer

Capacity One-third Yard



No. 2 Mixer

Capacity One-half yard



Chicago Improved Mixer

The Municipal Engineering & Contracting Company manufacture a machine known as the Chicago Improved Cube Mixer. (Plate XI) It is a batch mixer and consists essentially of a large cube mounted on trunnions on diagonally opposite corners; so constructed to charge from one end and discharge from the other. The corners and edges of the cube are rounded; thus lessening the liability of the concrete being pocketed. Within the cube are breaker rods connecting the centers of the adjacent sides. As each of the six sides is moved under the mass in the bottom, it carries part of it up until the slope exceeds the angle of repose when it begins to fall. As the cube is revolved rapidly this falling consists of a separating at the upper edges, and rolling down over the breaker rods, and folding over on

the following layer. This causes the entire mass to be subdivided and doubled over in each revolution. The cube is rotated at the rate of about 15 revolutions per minute.

The machine is discharged by depressing a lever, which tilts the cube in an inclined position and the concrete rolls out (Plate XI. Fig. 2) The cube is mounted in a swinging frame, the latter being pivoted to a fixed frame. To lessen the labor of charging the machine the company have built a steel charging elevator supported by the same truck which carries the engine and mixer. (Plate XI. Fig. 2 & 3) This elevator device is essentially an inclined runway for a large bucket. The bucket is charged within 14 inches of the ground, and moves up the incline by means of ropes and pulleys to the mouth of the mixer. The bucket is operated by the engine. When no charging device is used, the materials are simply shoveled into the receiving

hopper from which they pass directly into the cube.

The machine is rotated by means of a large gear ring passing around the cube, which in turn engages a small gear mounted on the end of a shaft. (Plate XI. Fig 1) This shaft is held by the fixed frame of the machine, and on the opposite end is another gear wheel which again meshes with the gear on the main shaft of the engine. The machine may be charged and discharged while running at full speed.

The Chicago Improved Mixer is made in six sizes ranging in capacity from 7 to 70 cubic yards per hour and requiring from 3 to 20 H.P. to operate.

Plate XI

Fig 1

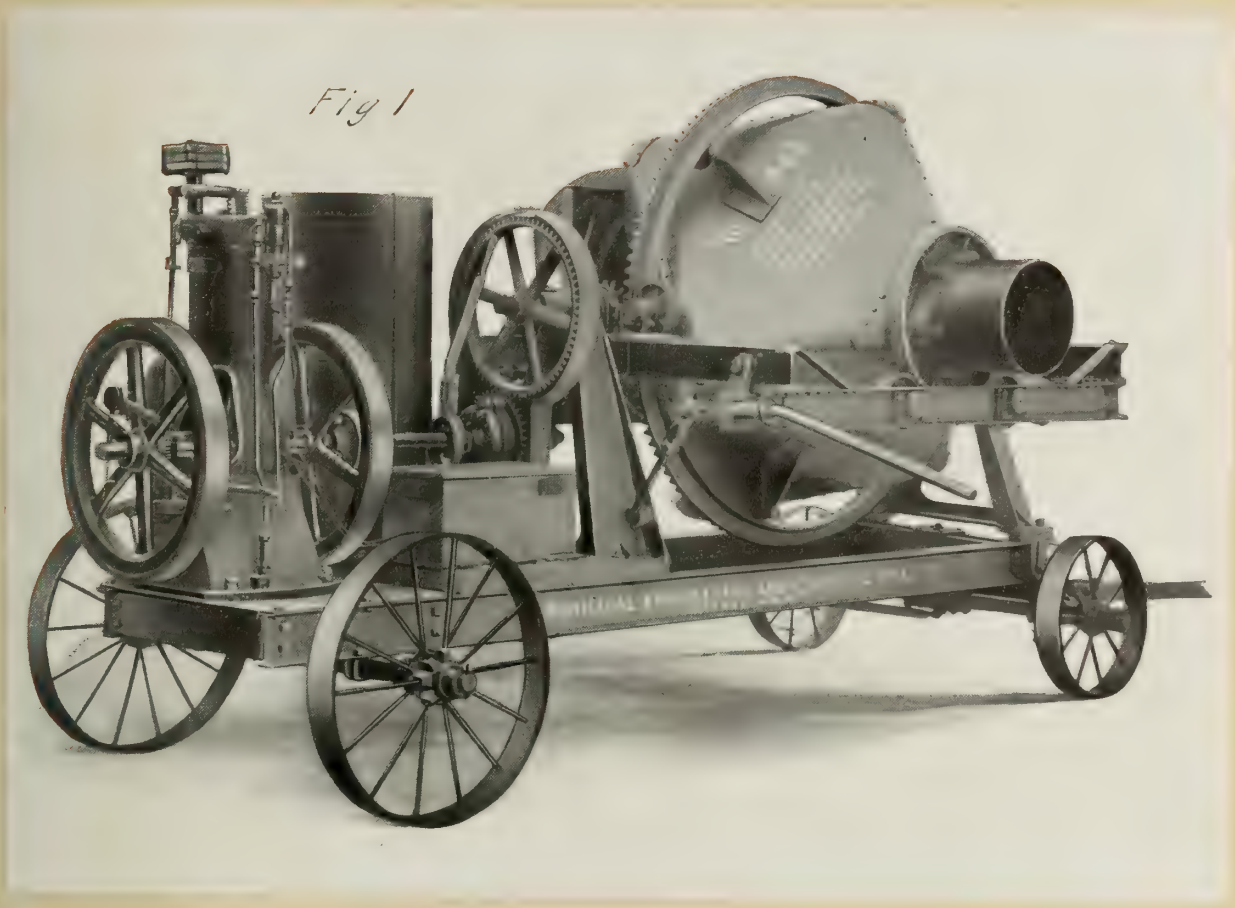


Fig 2

Fig 3

CHICAGO IMPROVED CUBE CONCRETE MIXER

With Charging Elevator, showing both loading and discharging positions.

Judd Mixer

Another type of cube mixer is the Judd Concrete Machine, manufactured by the Ockburn Barrow & Machine Company. It is also a batch mixer. The cube is mounted on diagonally opposite corners and revolves on rollers; (Plate XII) thus causing the ingredients to be thrown from side to side six times in one revolution. The cube is simple in design and contains no mixing blades or paddles within.

The mixer is of such construction that it is charged and discharged while in motion, the discharge being accomplished by simply reversing the direction of rotation by means of a reversing gear. (Plate XII. Fig. 2) Three discharge scoops are so placed within the cube that they converge to the discharge opening. When the cube revolves in the mixing direction, they are inoperative, but when the rotation is reversed the concrete is

collected by them and discharged. These scoops are rigidly secured to the inner side of the cube, but in such manner that they can be easily removed when desired. The machine does not tilt to discharge its product, this being accomplished wholly by the scoops; and at sufficient height for the contents to fall into a wheelbarrow, or similar receptacle. No automatic device is provided for charging the machine. The materials are simply put into the cube and water admitted at the same time.

The machine is rotated by means of a large gear ring encircling the cube. (Plate XI. Fig 1) This large ring engages a smaller gear wheel, which in turn meshes with the gear on the engine shaft. The mixer is driven by either reversing or non-reversing engine or motor, a reversing gear being provided in the latter case.

The machine is made in standard sizes of 1/3, 3/4, and 1 cubic yard capacity per batch.

Plate XII

JUDD MIXER

Fig 1

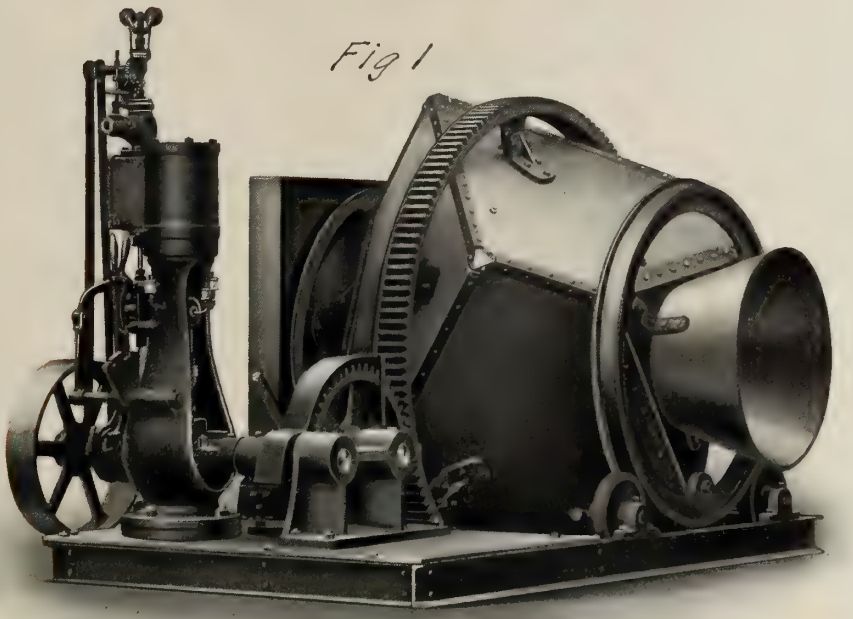


Fig 2

Hains Mixer

The Hains Concrete Mixer, manufactured by the Hains Concrete Machinery Company, is strictly a gravity machine. (Plate XIII). It consists of four conical hoppers, nesting one within the other. (Plate XIII. Fig 1) The hoppers are connected together by chains, and when the bottom hopper is lifted clear of the ground they hang suspended, one below the other, as shown in Plate XIII, Fig. 3.

The mixer is operated in the following manner:- The hoppers being in the nesting position (Plate XIII Fig 1) with the cone in position at the bottom; the cement is placed in the top hopper and leveled off; the proper quantity of sand is next added and similarly leveled; on top of the sand is placed the gravel, if used, and last the the broken stone is added. The several ingredients are now in horizontal layers proportional to the quantity of each, and

are ready to receive the proper amount of water. This is sprayed, a dasher, evenly over the top, thereby wetting the entire mass, except the layer of cement, which acting as a dam, retains dry and holds the water in the hopper.

The derrick, or other hoisting cable, is now made fast to the chain tripod of the top hopper, and the hopper is lifted about two feet, or the length of its connecting chains. (Plate XIII. Fig 2) In doing this the cone is raised, and passing through the ingredients distributes the cement throughout the mass. The door or valve of the hopper now automatically opens and allows the charge to flow into the next hopper below, where it is caught and held. As soon as this takes place, another lift of about two feet will raise the second hopper the length of its chains, automatically opening its door, which allows the partially mixed concrete to flow into the third hopper, where it is again caught

and held. The mixer is now lifted bodily and swung around to the place where the concrete is deposited. During this operation the door of the third hopper has automatically opened, allowing the mixture to flow into the fourth, or last hopper, where it remains until a man pulls the tag line, connecting with this hopper and allows the mixed concrete to flow out. The whole apparatus is then swung back to the loading position, the hoppers allowed to settle themselves, one within the other, and the operation repeated.

By using a pair of mixers, and loading one while the other is being discharged, the operation may be made a practically continuous one. A very convenient feature of this machine is the delivery of the raw materials at the lowest working level. The operation of mixing them being performed in the mixer, it is unnecessary to elevate the ingredients in order to charge the mixer. The machine is capable of mixing batches in any size up to $\frac{2}{3}$ cubic yards. Weight 14,000 pounds complete.

Plate XIII

HAINS MIXER

Figure I.

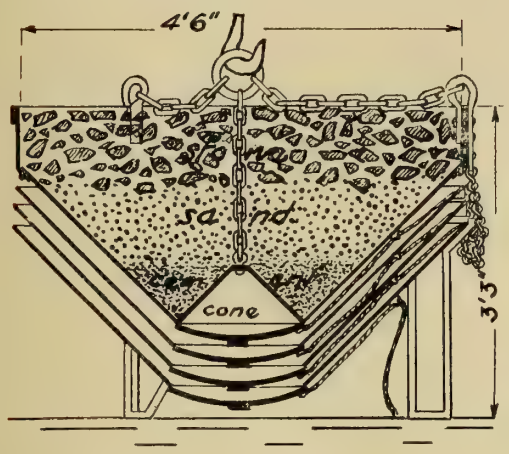


Figure II.

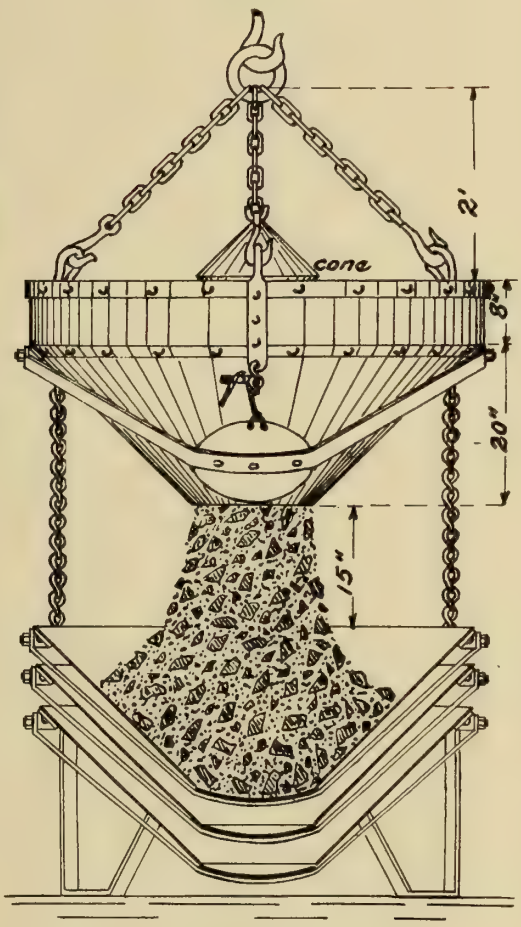
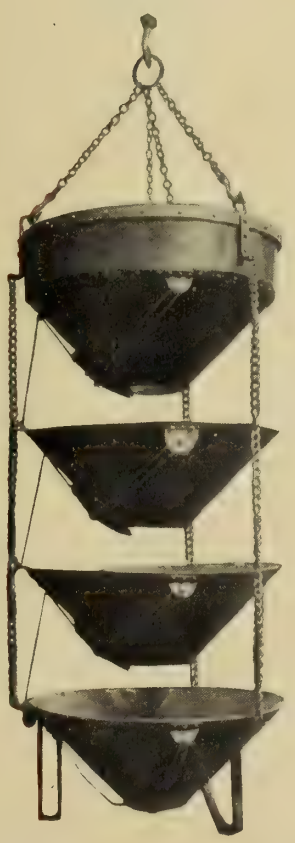


Figure III.



CAPACITY

Batches in any size up to $\frac{2}{3}$ cubic yard

WEIGHT

1,400 pounds complete

HEIGHT

The extreme height is adjustable from 12 feet for small batches to 13 feet 6 inches for full capacity

Drake Mixer

The Drake Standard Machine Works manufacture a Concrete mixer mounted on a flat car with adjustable conveyor and moving device. (Plate XIV) This mixer is a continuous mixer and is used for railroad or large work. The concrete car is a flat car, fitted with a Drake duplex double-shaft concrete mixer, a concrete conveyor, a 25 H.P. vertical engine and boiler, and winding drums for operating the propelling cable. The machinery is roofed over, the roof forming a deck or floor from which the materials are dumped into measuring boxes. The concrete mixer is of the form shown in Plate XII Fig. 2. It consists of a steel trough 30 inches wide, the bottom of which is curved to the radius of the mixing blades. In the box are set two shafts fitted with blades and scoops. There are about 60 blades and scoops in all, those on one shaft alternating with those of the other.

These turn the material over giving it a thorough mixing, while at the same time, they force the material along towards the discharge end. The two shafts are geared together, revolving in opposite directions, and one shaft also carries a spur wheel gearing with a pinion on a sprocket wheel shaft which is driven from the engine. The machine will make 400 to 500 cubic yards of concrete daily, and requires about 25 H.P. for its operation. It is 12 feet 6 inches long, 5 feet 6 inches wide over the oak frame, and 2 feet 2 inches high over the hopper. A perforated pipe extending longitudinally over the hopper for about half its length from the discharge end supplies the water in the proper quantity. The materials are well mixed dry before reaching the water pipe.

The charging device consists of screws, running right and left, (Plate XI) so as to deliver the material as near as possible at the center and end of the mixing hopper. The three hoppers

are of different size, corresponding with the proportions used of stone, sand, and cement. The power to operate the feed screws is taken from the mixing shaft below. The proportions of the different materials can be varied by changing the sprocket wheels on the screw shaft. An index plate on the machine shows which sprocket wheel to use for each hopper, each turn of the screw delivering a certain number of cubic inches of material into the mixing hopper.

The train consists of three or four cars of stone and sand, and a box car of cement. Wooden runways are placed along the sides of the cars, upon which men with wheelbarrows convey the material to the deck of the concrete car. (Plate XIV. Fig. 1) Here they are dumped into two measuring boxes, side by side, one being filled while the other is being discharged. From the boxes the materials drop directly into the hopper of the concrete mixer. The head of the car

is also equipped with a belt conveyor 25 feet long, or longer if required, mounted on a steel boom. (Plate XII. Fig 1) The heel of the boom is mounted on a turntable, so that the conveyor can be swung through an arc of nearly 180 degrees. The boom is also hinged at the heel and supported by guys from a gallows frame on the deck of the car, so that the height of the delivery end can be adjusted as required. The conveyor dispenses entirely with the concrete wheeling gang, and delivers the material in a more desirable condition.

Another important feature of the equipment is that the entire train is self-propelling. Instead of a locomotive being attached to the rear of the train, a double drum winding apparatus is placed on the car, being driven from the same engine which supplies power for the mixer and conveyor. Around the drums is wound eight turns of $\frac{3}{4}$ inch wire cable which passes through a slot

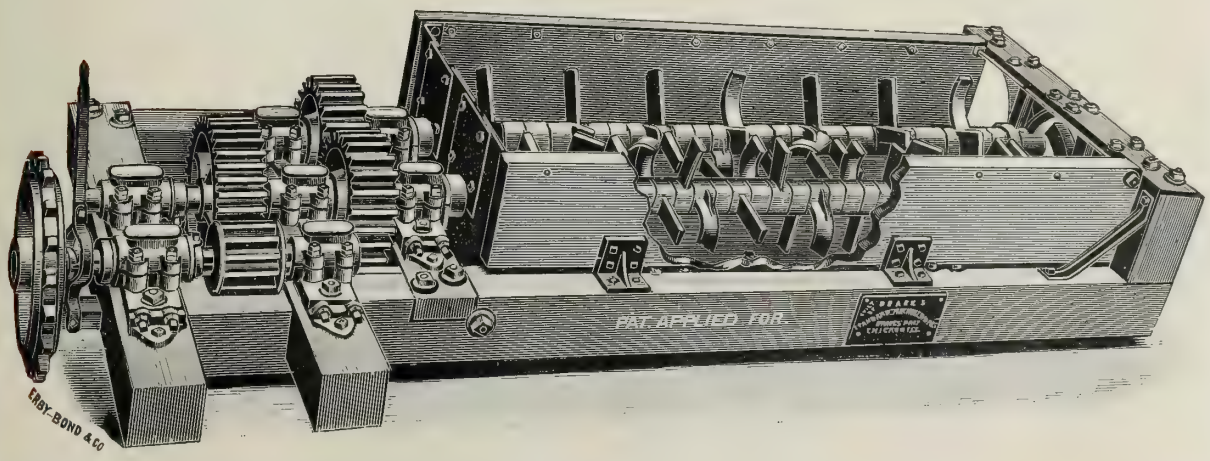
in the floor. From the forward drum the cable extends to an anchor tie 500 feet in the rear; while from the rear drum it extends to an anchor tie 500 feet ahead. By this arrangement, the train is moved steadily forward and backward at the required speed, the wheelbarrow gang of about 25 men keeping the mixer supplied with material, and the conveyor delivering a continual stream of concrete into the forms.

While these delivering and depositing machines are comparatively new, the Drake concrete mixer already described is in very extensive use in both stationary and portable forms, and with one or two shafts according to the capacity. For large work the automatic feeders and conveyor are used, but the mixer alone can be supplied without any of these appliances. Last price, outfit complete $3,650.00, mixer only $1,100.00

Fig 1

Drake Concrete Mixer, Duplex No. 1, mounted on flat car with Adjustable Conveyor and Moving Device. Description on next page.

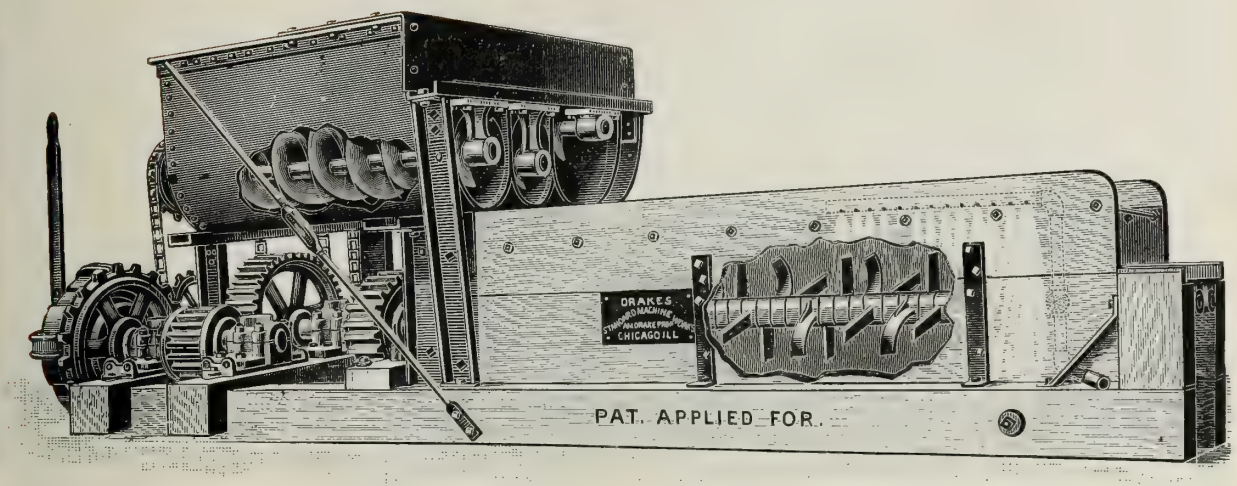
Fig 2



DUPLEX No. 1.

Plate XV

DRAKE
CONCRETE MIXER



DUPLEX No. 1—With Automatic Feeder and Grader.

Trump Mixer

The Link Belt Engineering manufacture the Trump continuous concrete machine. (Plate XVI) It consists essentially of an automatic measuring device and water feed, and a trough for mixing the materials. The measuring device consists of a horizontal revolving table, on which rests the material to be measured, (Plate XVI. Fig 2) and a stationary knife set just above the table and pivoted on a vertical shaft outside the circumference. The knife can be adjusted to extend the proper distance into the material and peels off, at each revolution of the table, a certain amount which falls into the chute. The material peeled off is replaced from the supply, contained in a bottomless storage cylinder somewhat smaller in diameter than the table and revolving with it. (Plate XVI. Fig. 1) The depth of cut of the knife is adjusted by swinging the knife around on its pivot, so that it extends a

greater or less distance into the material. The swing is controlled by a screw attached to an arm, cast as part of the knife. A micrometer scale with pointer indicates the position of the knife.

When it is desired to measure off the three materials, the machines are made with three tables, set one above the other and mounted on the same spindle, so that they revolve together. Each table has its own storage cylinder above it, the cylinders being placed one within the other, as shown in Plate XVI Fig 1. There is a knife with its own adjusting mechanism for each table, which enables the user to vary at will the percentage of each material in the mixture. The materials flow together constantly and regularly in small streams into the common chute. The table mechanism is carried on a hinged door, so that it can be inspected or repaired. A cover extends over the adjusting screw, and is provided with a lock to insure

that the proportions of the concrete cannot be changed, nor the door opened.

As the materials leave the measuring tables, they fall in thin streams of stone, sand, and cement, the particles becoming somewhat separated in falling. Two sprays, from pipes placed on each side of the descending materials, play on and through them, and moisten the mass. The flow from the sprays is kept constant by a small receiving tank on the machine. The tank contains a float valve and insures a constant flow. The rate of flow is adjusted by an ordinary valve between the tank and sprays, and a second valve permits shutting off the supply when the machine stops, without disturbing the adjusting valve.

The materials, now measured and moistened, fall into the trough where the mixing is done by hardened steel paddles, revolving on a horizontal shaft. (Plate XVI. - fig 3) These paddles are set at an angle,

and by revolving turn the material over and grind it together; while at the same time it is moved along toward the discharge end. The concrete falls from the trough ready to lay. A gate at the end of the trough permits the concrete to be retained, if it is not wanted at once. The paddles may be kept revolving while the measuring device is stopped by means of a clutch.

The machine is driven by a system of gearing, mounted on a shaft underneath the tables, (Plate XII. - fig. 3) which in turn is propelled by a gasoline engine. An electric motor, steam engine, or steam engine and boiler can be furnished instead of the gasoline engine if desired.

The capacity of the machine, running with the measuring tables and making five revolutions per minute, is about 50 cubic yards per hour.

Plate XVI

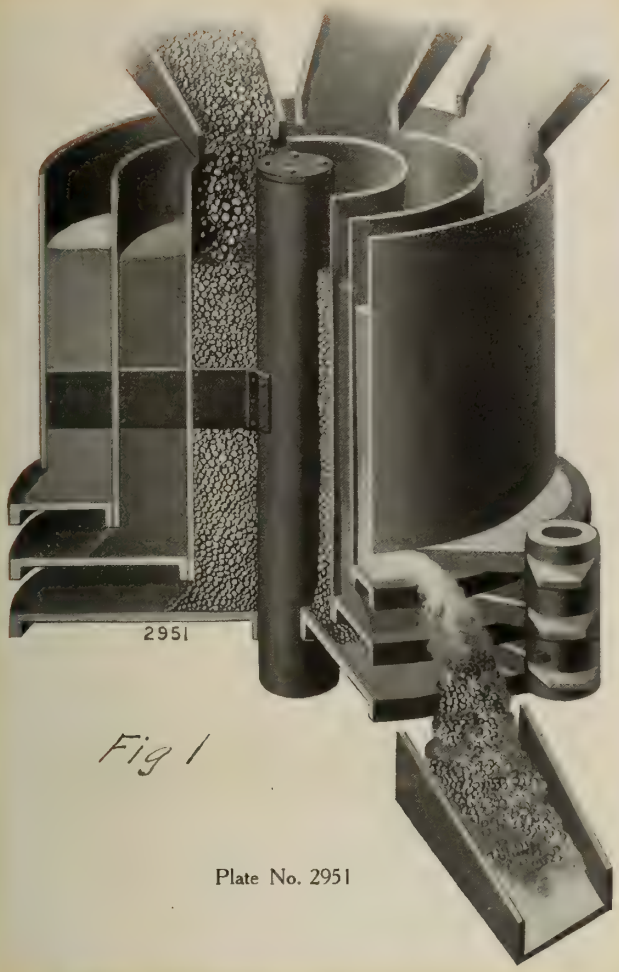


Fig 1

Plate No. 2951

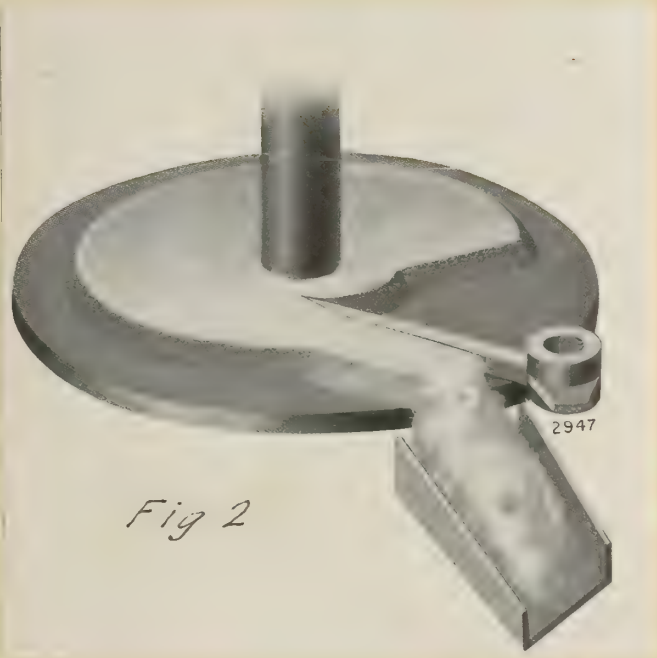


Fig 2

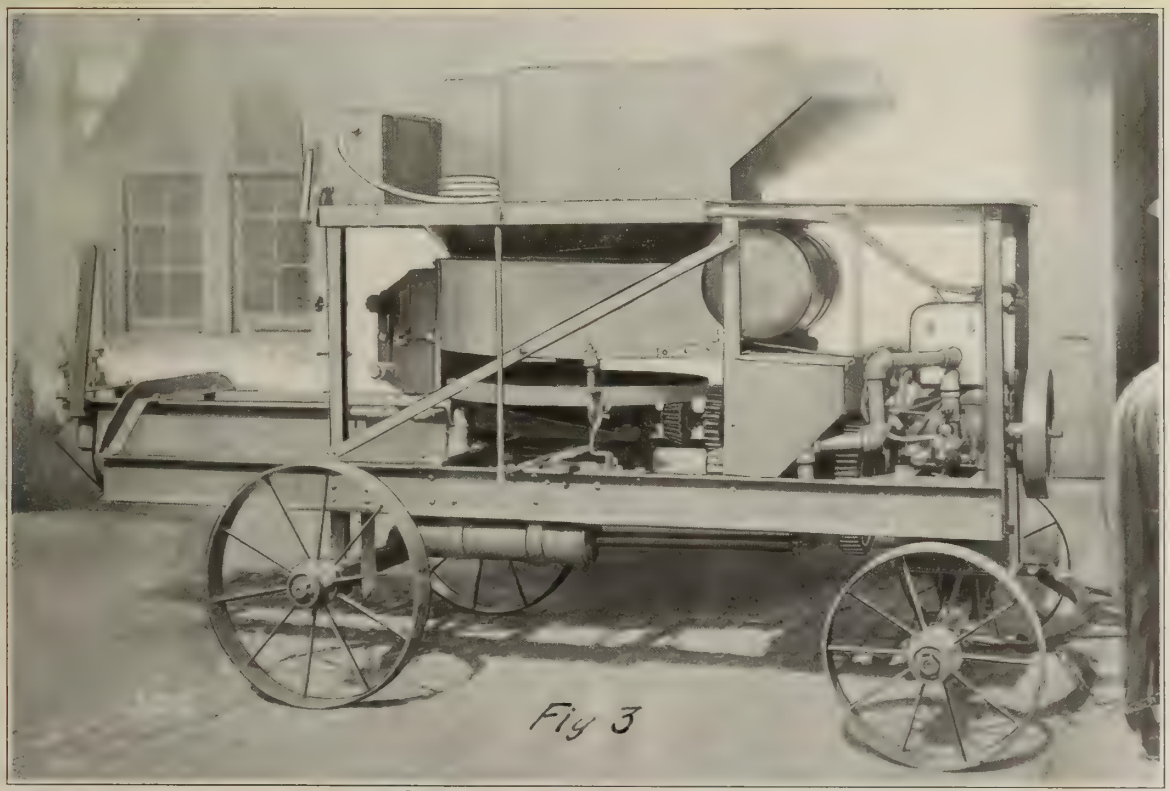


Fig 3

TRUMP MIXER

Foote Mixer

The W. H. Wilcox Company manufacture what is known as the Foote Concrete Mixer. (Plate XVII) It is a continuous mixer and consists of a mixing drum with automatic feed hoppers, (Plate XVII. Fig 2) and an automatic arrangement for wetting the materials. There are three mechanical feed hoppers. The stone and sand hoppers are on opposite sides of the machine, at a height of about 3½ feet from the ground. The cement hopper sets back and above these. At the bottom of these hoppers, feed worms, revolving at different speeds, force the materials constantly into the mixing drum in the proportions desired. (Plate XVII. Fig 2) By means of different sized Sprocket wheels, which slide on and off, the machine can be changed from one proportion to another.

The materials, fed into the mixing drum, are taken up and

mixed by a set of revolving wings and conveyors, mounted on a heavy template-shaped arm which bolts into the mixing shaft, as shown in Plate XVII. Fig. 3. These are set at opposite angles, thus carrying the mixture up in the drum and turning it over; while at the same time, they carry the mass along toward the discharge end. There are 2-4 wings and conveyors in all.

The mixture is wet automatically and evenly, while passing through the drum, by means of spray pipes, fed by a hose attached to the machine and regulated by valves. The water does not strike the materials until they reach the middle of the drum, which arrangement gives, first a dry mixing, and then a wet mixing. The materials are discharged directly into wheelbarrows upon reaching the discharge end of the machine. The feed worms can be thrown out of gear independently of the mixing wings.

The machine is equipped with

either steam, or gasoline engine, or electric motor as desired. The only mechanism necessary for propelling the feed screws consists of three sprocket wheels of different sizes, connected by a strong link-chain belt, (Plate XVII. Fig. 2) the moving ways being revolved by a set of gear wheels.

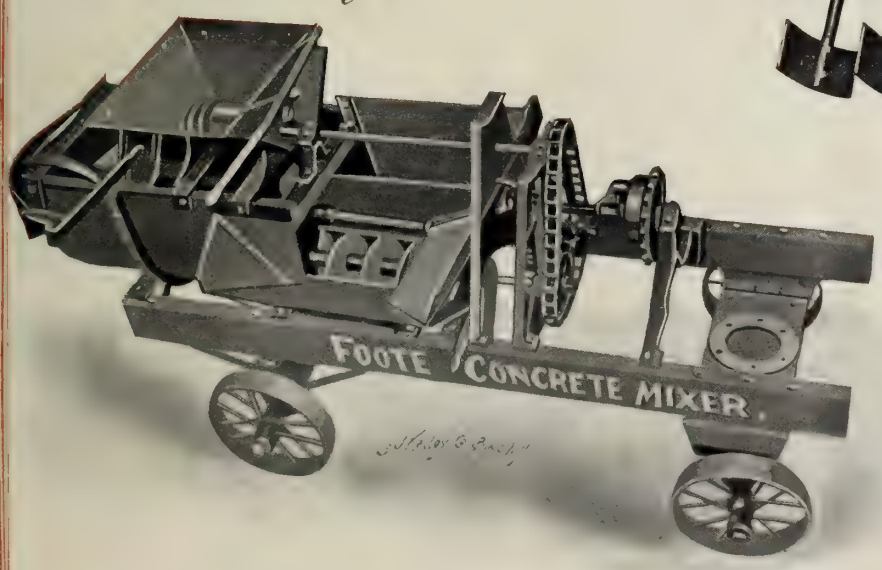
The five sizes of the machine are made ranging in capacity from 7 to 22 cubic yards per hour and requiring from 5 H.P. to 12 H.P. to operate. List price, on trucks without power $625.00 to $1,200.00.

Plate XVII

Fig 1

No. 3 Foote Mixer, complete with steam engine and boiler, on trucks.

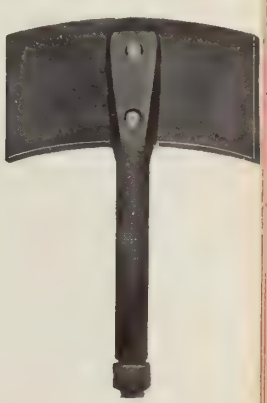
Fig 2



Skeleton view of No. 3 Foote Mixer, showing arrangement of automatic feed hoppers.

Mixing wings and arms attached to shaft.

Fig 3



Single mixing wing and arm.

Eureka Mixer

The Eureka Machine Company manufacture a machine of the continuous type, called the Eureka mixer. (Plate XVIII) It consists of a long horizontal trough open at the top, over one end of which are mounted two hoppers for the sand and cement and gravel, or broken stone. (Plate XVIII. Fig. 1) Through this trough runs a heavy steel shaft, upon which a series of paddles are mounted, as shown in Plate XVIII, Fig. 2. This long shaft is rotated, and as the materials are admitted from the hoppers, the paddles mix and move them along toward the discharge end where they pass out of the trough.

The machine takes care of the measuring as well. The materials are shovelled into the hoppers and are admitted to the mixing trough by means of a small block in the bottom of the feeders. (Plate XVIII, Fig. 2). When it is desired to change the mix,

the block in the feeders is changed by removing a bolt and dropping in another block, the blocks being numbered for the different sizes. Water is admitted through a hose into the top of the trough. A rotary pump is attached for use when out of the reach of city water. (Plate XVIII, Fig. 1)

The machine is propelled by a friction drive with chains and sprocket wheels. (Plate XIX) When anything gets into the wire too large to pass through, the friction drive will slip, thus preventing any breakage. Steam, gasoline or electric power may be used to operate the machine. It is also fitted to be run by hand. The capacity of the power driven machine is from 70 to 80 cubic yards per hour; while that of hand driven is about 20 cubic yards per hour.

Plate XVIII

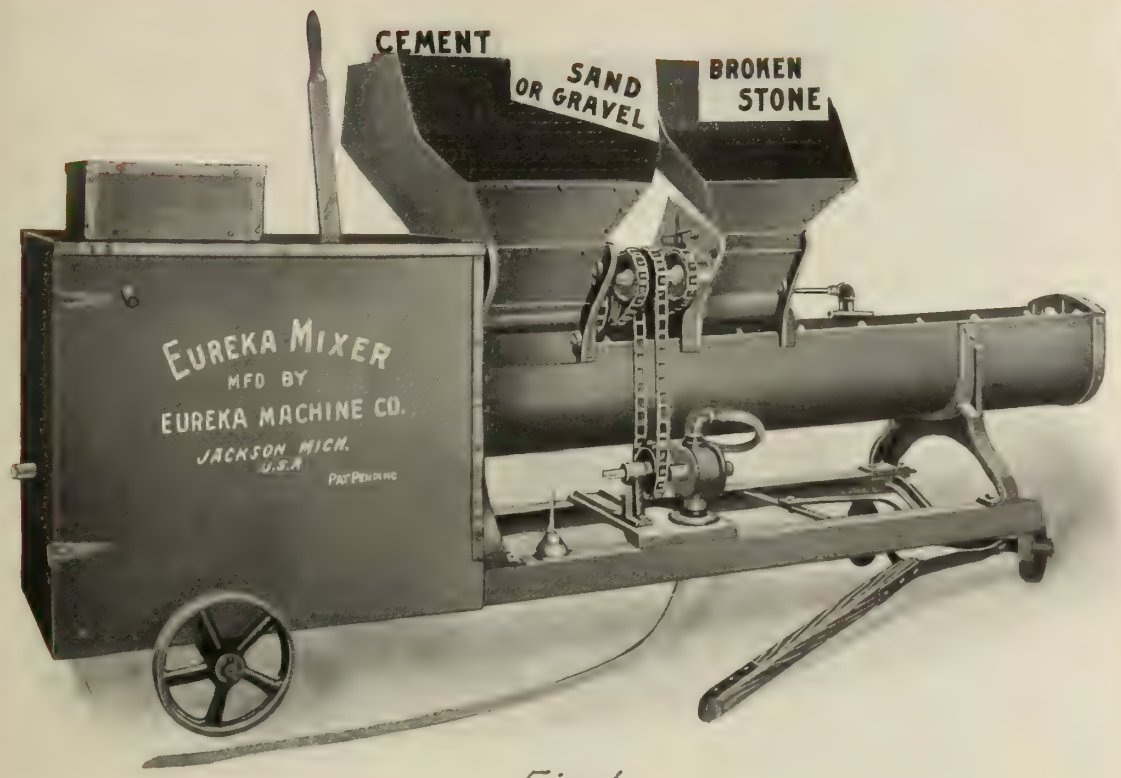


Fig 1

Eureka Power Mixer

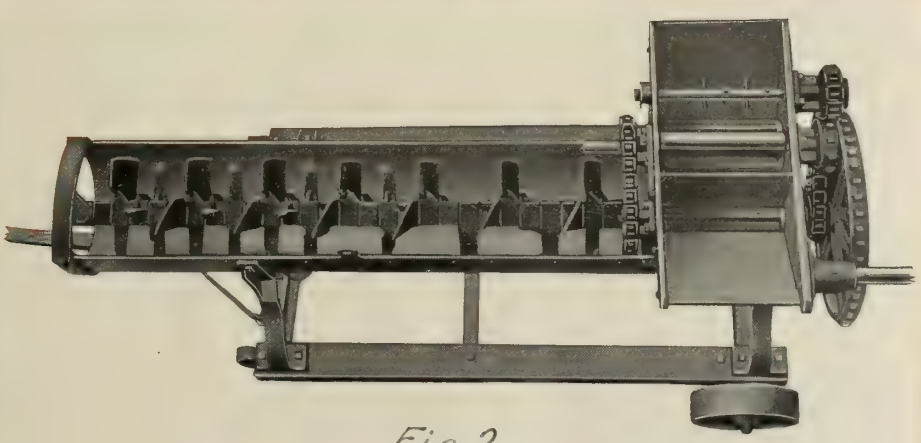
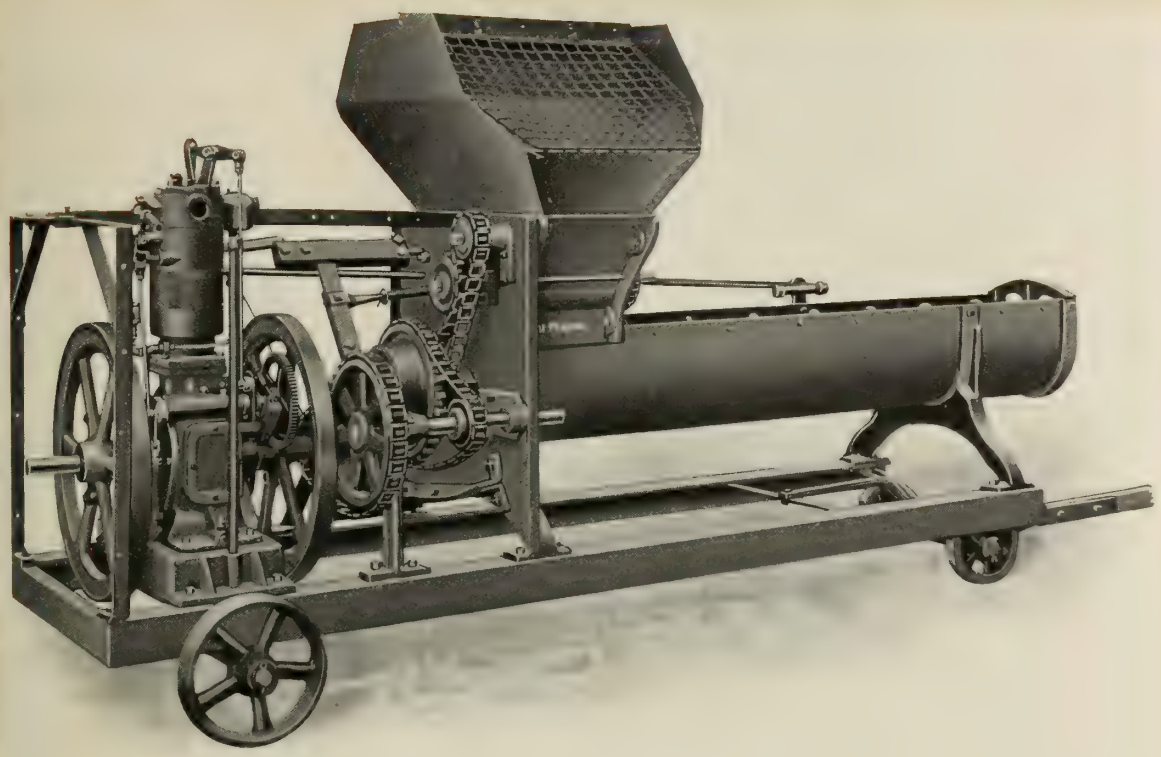


Fig 2

Inside View of the Eureka Mixer

Plate XIX



The Eureka Mixer, Mounted on Trucks

Scheiffler Mixer

The Scheiffler continuous mixer is manufactured by the Hartwick Machinery Company. (Plate XX) It is an automatic proportioning mixer, and the feeding device consists of a hopper divided into three compartments, the middle one for cement, and the outside ones for sand, gravel and rock. These separate hoppers are each provided with a cylinder cut-off feed, which can be set to discharge any proportion desired. All the cylinders feed at the same time and the mixing commences at the moment the different materials drop into the double mixing trough. (Plate XX, Fig. 2) This trough is a long cylinder through which pass two shafts, revolving in opposite directions. Mounted alternately on these shafts are steel conveyors and blades, set at an angle of about 45 degrees. (Plate XX Fig 2) The conveyors are circular discs which pass the material from one side of

the mixing trough to the other. Here the straight blades, set at a reverse angle of about 45 degrees, give it a backward thrust which returns the material toward the hopper; so that the mixture travels and retravels the mixing trough before being discharged. No automatic discharge is used, the materials simply pass out of the machine upon reaching the end of the trough. The water is added to the materials as they pass out of the hoppers into the trough. The feed can be shut off at any time without stopping the machine. If desired, automatic elevators are furnished for feeding the materials into the hoppers.

The machine is mounted in a steel frame with trucks, and the mixing shafts are propelled by means of sprockets and chain. (Plate XXI.)

Three different sizes are placed on the market with capacities of 5, 10, and 20 cubic yards per hour, requiring from 2 H.P. to 4 H.P. to operate.

SCHEIFFLER MIXER

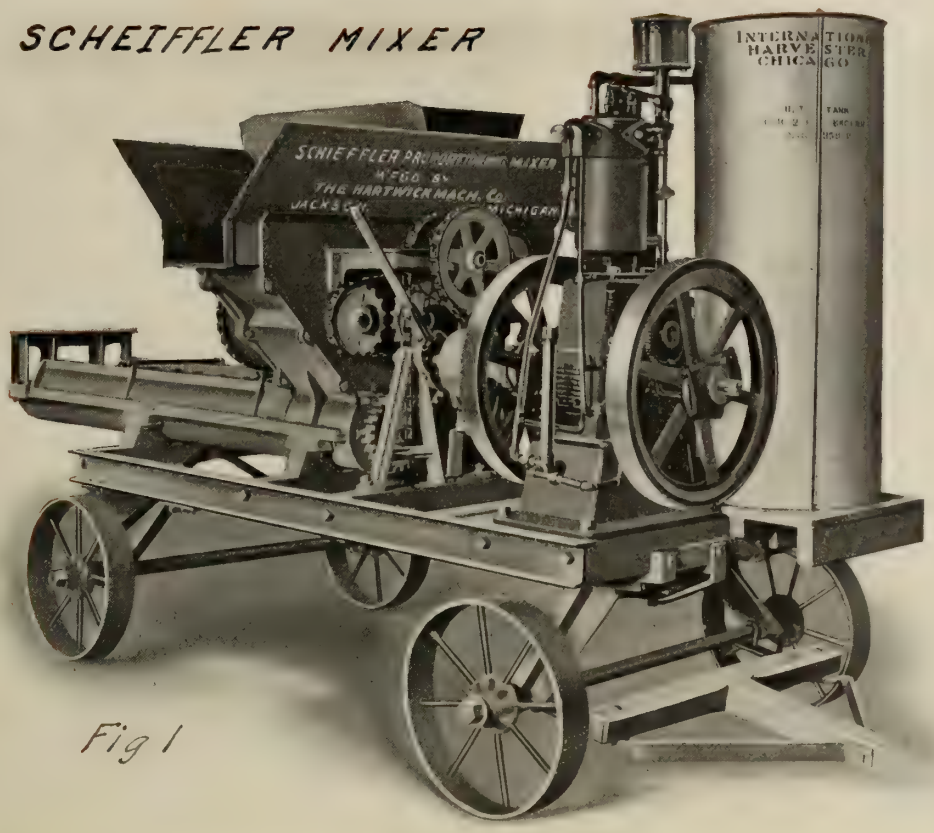


Fig 1

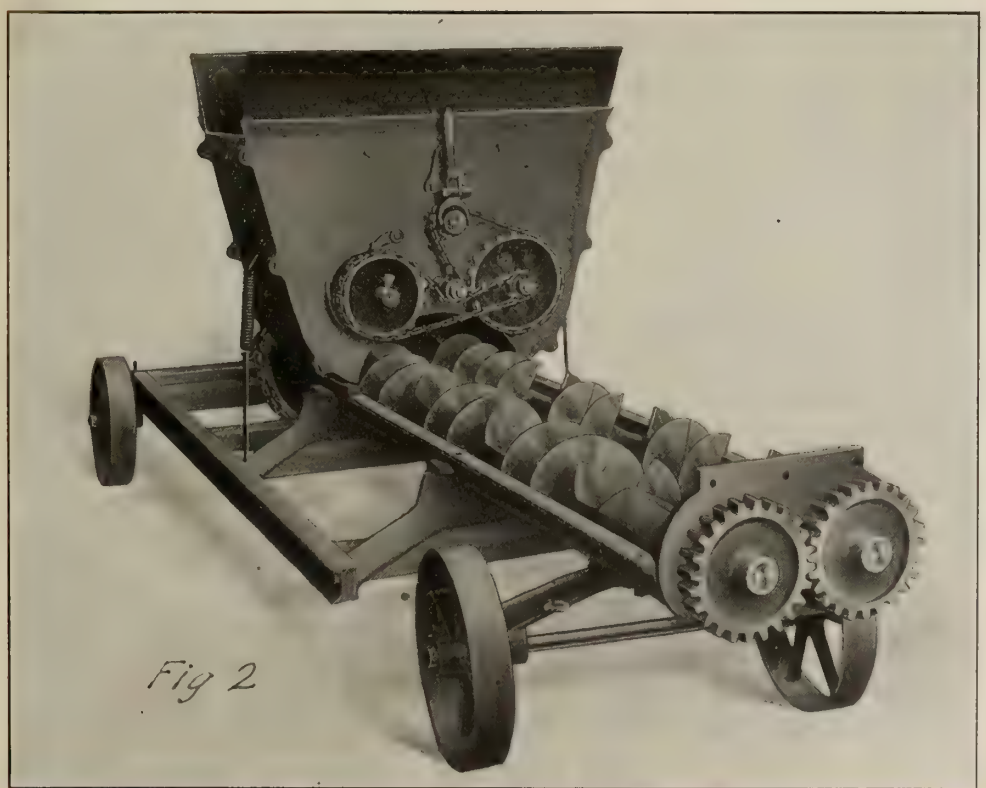
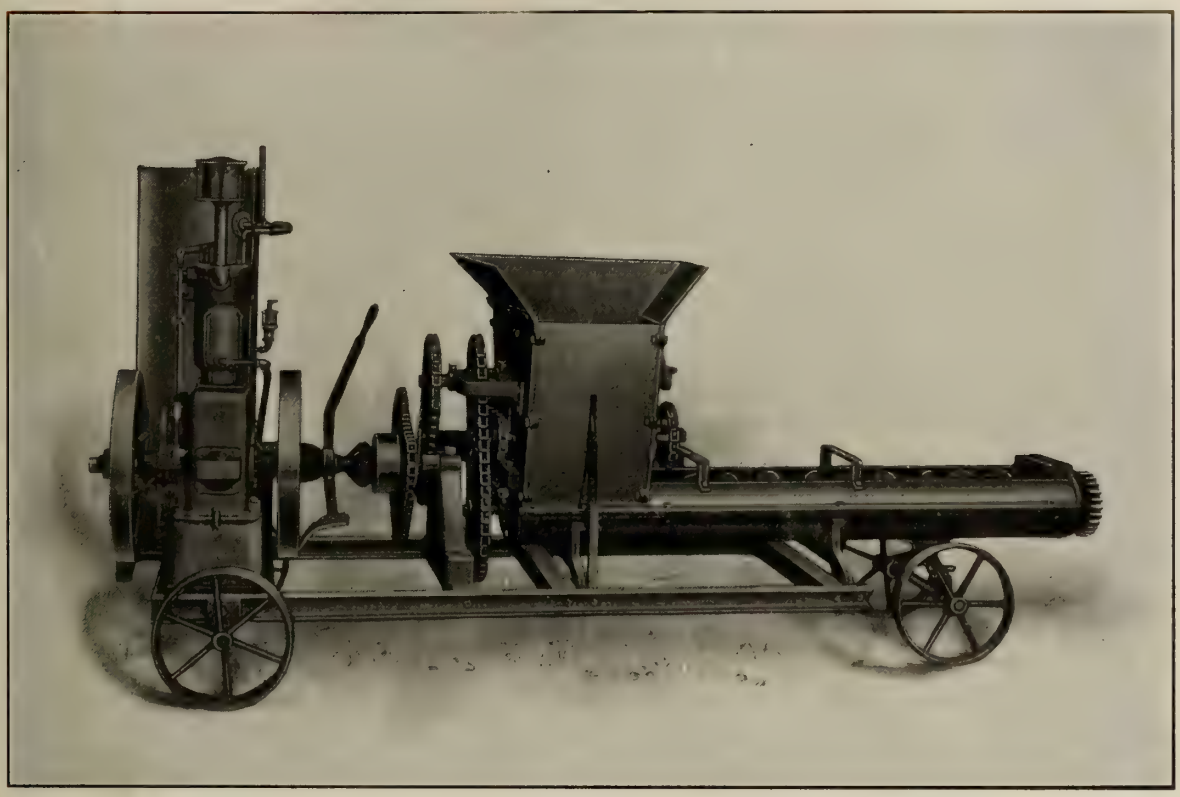


Fig 2

Plate XXI

SCHEIFFLER MIXER



The above illustration shows our No. 2 Mixer with Friction Clutch and Direct Chain Drive.

Jeffrey Mixer

The Jeffrey Manufacturing Company produce another type of machine known as the Jeffrey Continuous Mixer. (Plate XXII) It is essentially a long horizontal trough open at the top, through which passes horizontally a heavy steel shaft. Upon this shaft are mounted a series of iron paddles which take the shape of a screw-propeller of a marine vessel. (Plate XXII, Fig 1) The shaft is rotated by power, and as the materials are shovelled into the trough, the paddles tend to mix them and move them toward the discharge end. The trough is usually placed with a slight inclination to aid the thrust of the paddles in causing the concrete to run out at the lower end into wheelbarrows, or other receptacle placed for it. The water is admitted through a hose resting over the edge of the trough near the charging end.

The whole machine is mounted on a frame supported by trucks. A

3 H.P. gas engine supplies the power, which is transferred to the mixer by means of a belt and a system of gearing. (Plate XXII, Fig 2)

The machine is made in different sizes to suit conditions, the only variation being in the length of the mixing trough. The capacity is about 30 cubic yards per hour. List price, engine included, $475.00 to $510.00

Plate XXII

JEFFREY
PORTABLE
MIXER.

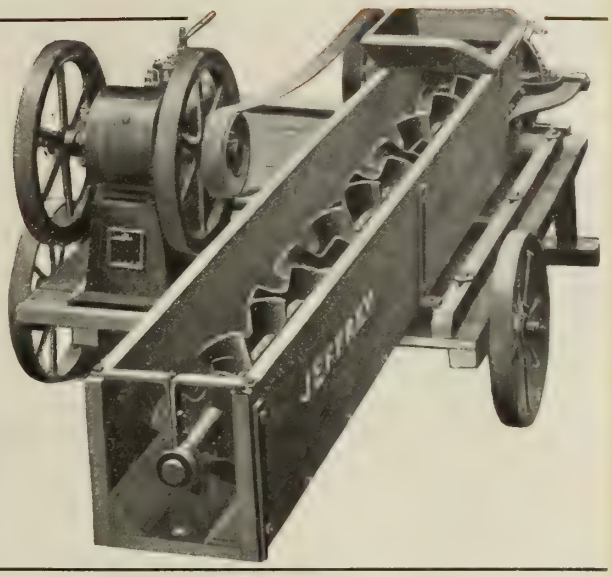
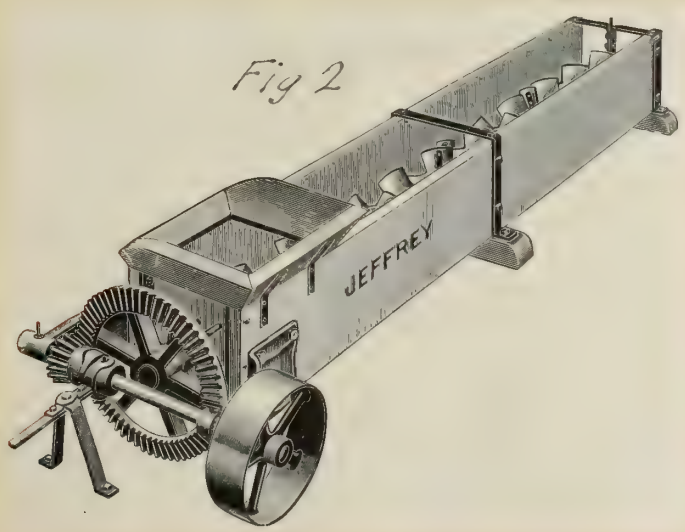


Fig 1

Fig 2



Julian Scholl Mixer

This continuous mixer is manufactured by Julian Scholl and Company. The mixing chamber consists of a cylinder 6 feet in length and 2 feet 6 inches in diameter, open at the top. (Plate XXIII) Through this chamber runs a shaft of square cross-section on which are bolted a number of steel blades. These blades are set at an angle, and as the shaft is rotated they plow their way through the material, thus grinding it together and at the same time move it along toward the discharge end. The shaft is geared to make about 20 revolutions per minute, and requires an 8 H.P engine to operate.

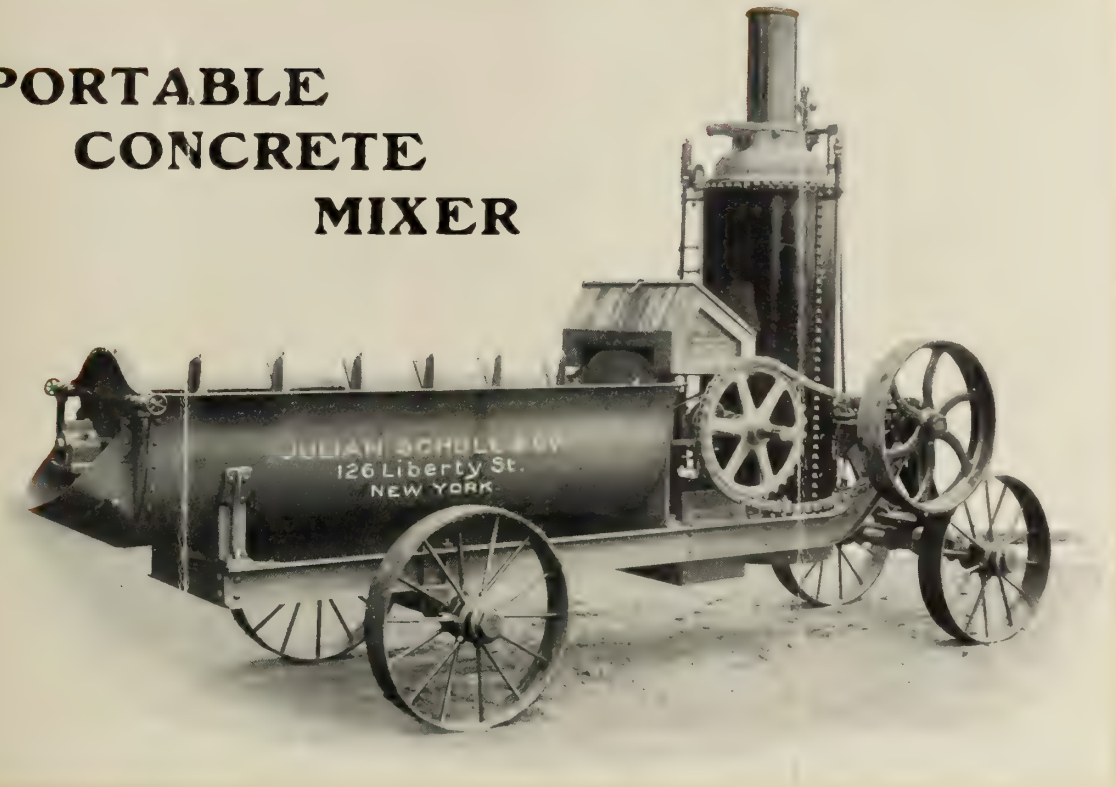
The materials are dumped into the machine at the upper end of the mixing trough, the water being added at the same time through a hose. The discharge is at the lowest point, the concrete simply dropping out of the mixing chamber on reaching

the end. (Plate XXIII)

The driving mechanism consists of a sprocket and chain. (Plate XXIII) On the shaft holding the sprocket is mounted a gear wheel, which meshes with another gear mounted on the mining shaft, thus propelling the latter. The miner is also furnished with gears and pulley for belt drive. The capacity of the machine is about 25 cubic yards per hour.

Plate XXIII

PORTABLE CONCRETE MIXER



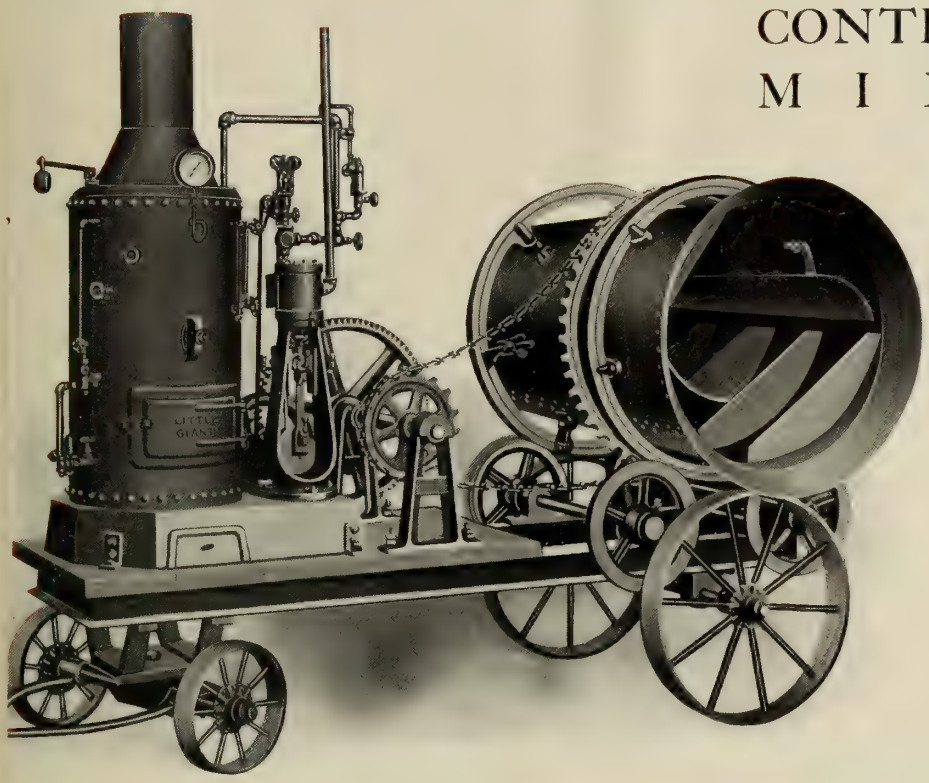
McKelvey Mixer

The McKelvey continuous mixer (Plate XXIV) is very similar to their batch mixer in its method of charging and in propelling the mixing chamber. (See McKelvey batch mixer page 15) It consists of a long cylinder mounted on four rollers, the same as the batch mixer. It also contains the gravity shovels, but in addition there are deflecting blades (Plate V. Fig 2) placed within the cylinder in such a manner as to prevent the material from being conveyed through the cylinder in a body, the same as it enters it. They, in connection with the gravity shovels, cause the material to be intermingled longitudinally in the drum, turned over, and mixed circumferentially about 12 times during its passage through the mixer.

The discharge is simply the passing out of the materials upon reaching the end of the drum. The machine is made in four sizes ranging in capacity from 5 to 30 cubic yards per hour.

Plate XXIV

McKELVEY CONTINUOUS MIXER



Demorest Mixer

The Demorest machine is manufactured by the Ballou Manufacturing Company. (Plate XXV) It is a continuous mixer with automatic feed. There are two hoppers mounted over the mixing chamber, one for sand and gravel, and the other for cement. The materials are fed from these hoppers onto a rubber feed belt 10 inches wide, and running over two pulleys 10 inches apart. (Plate XXVI, Fig 1) One of the pulleys is mounted on the main shaft and the other on a counter shaft. The feed is controlled by manipulating small gates or slides, which can be raised or lowered as desired. To keep the materials from clogging and failing to go through the gates to the feed belt, there are heavy metal springs in each hopper that work as agitators and prevent the sand and cement from clogging at the bottom.

After reaching the mixing chamber, which is a large cylinder or drum 4 feet long and 16 inches in diameter at the hopper and 19 inches at the discharging end, the materials are mixed dry. On the inside of the mixer are six ribs of $\frac{3}{4}$ inch angle iron riveted in the form of a spiral to the wall of the drum. (Plate XXVI Fig. 2) These ribs plow through the materials and carry a portion up the side of the cylinder, until overcome by the action of gravity when they drop back into the mass. They also aid in carrying the concrete along toward the discharge end, but this latter movement is further accomplished by the inclination of the drum. (Plate XXV) After the materials are dry mixed they come in contact with a spray of water from a pipe, protruding about 15 inches into the discharge end of the drum. (Plate XXVI, Fig. 2) This pipe leads from a water tank directly above the mixer, and the supply of water is governed

by a one inch globe valve. To keep the concrete from sticking to the side of the cylinder a steel blade projects inside the drum, (Plate XXVI, Fig 2) cutting the wet mixture from the sides; while at the same time, on the outside of the drum is an automatic hammer that strikes the exterior at each revolution. The discharge end is open at all times and the concrete passes out upon reaching that point.

The machine is fitted to be run by power, or by hand. If run by hand, a crank is attached to a large wheel mounted on the main shaft. (Plate XXV. Fig 2) If power is desired a 2 H.P. gasoline engine is used, connected by gears to the mixer. (Plate XXV, Fig 1) The capacity is about 6 cubic yards when the machine is propelled by hand, and about 30 cubic yards per hour with the engine. List price $200.00 for hand machine; cancel $500.00 with engine.

Plate XXV

Fig 1

DEMOREST MIXER

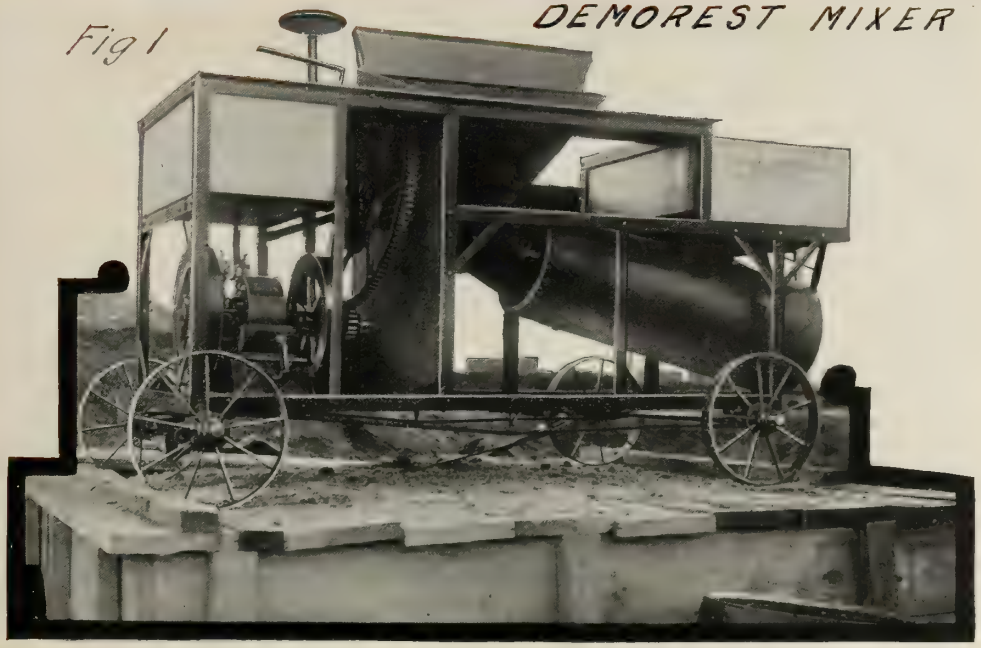


Fig 2

Plate XXVI

Fig 1

Showing Cement and Sand Running on Feed Belt to the Mixer.

Fig 2

Cook Mixer

The Cook continuous mixer is manufactured by the Cook Manufacturing Company. (Plate XXVII) The mixing drum, hexagonal in form, is mounted on steel rollers and the whole machine is mounted on an iron frame. There are no spaddles, blades, or other parts inside the mixing chamber, the mixing being done entirely by the revolution of the hexagonal drum which causes the materials to be rolled over six times in each revolution. The discharge end of the drum can be raised or lowered to suit conditions, thereby giving a longer or shorter mix.

The machine is charged simply by shoveling the materials into the hopper. A small amount of dry mixing takes place in the drum before the water strikes the materials, which it does in the form of a small spray through a perforated pipe. The discharge end of the machine

is open at all times and when the materials reach this point, they flow out in a continuous stream of mixed concrete. The discharge is 2 feet 6 inches from the tread of the wheels and 1 foot 2 inches beyond the truck wheels.

The machine requires a 2 1/2 H.P. gasoline engine for operation and is run by a belt and pulley. The pulley operates a set of gears which mesh with a large gear ring passing entirely around the mixing chamber. The capacity of the machine is from 4 to 7 cubic yards per hour.

The company makes a smaller mixer exactly like the one just described, which is operated by hand, and has a capacity of about 4 cubic yards per hour.

Plate XXVII

Fig 1

COOK MIXER

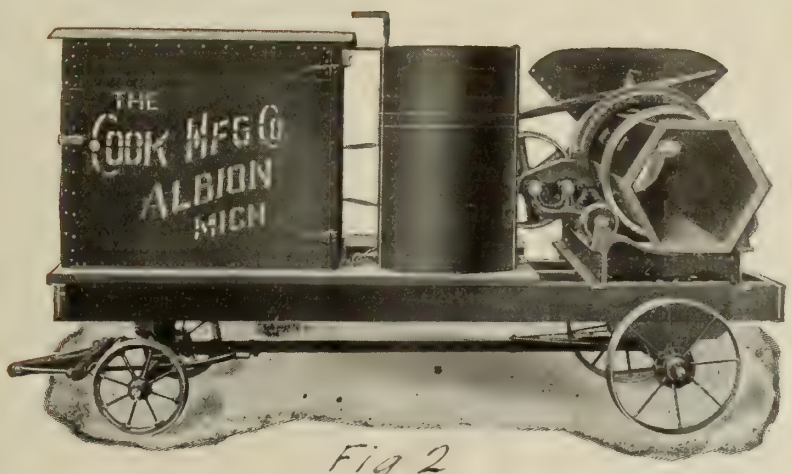


Fig 2

Conclusion . .

The foregoing presents the principal types in which concrete mixers are made. They are all machines which have proved successful in operation, although different engineers have individual preferences. In this country a decided favor is shown for concrete mixers of the batch type, and this because it is a much more logical process; since the materials can be turned over and over and tumbled about until there can be no doubt of an intimate mixing. In the continuous mixer, the materials are pushed along from one end of the trough to the other. There is no reciprocating motion, and if the trough is short, it is doubtful if the materials are sufficiently intermingled to insure a uniform product, because the time of mixing cannot be regulated. On the other hand, the continuous mixers

have the advantage of greater capacity and lose no time in feeding or discharging. The question of choice is more often one of local requirements than of absolute efficiency and often the same machine is fitted in different ways to render it adaptable to the various requirements.

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